ELECTRICAL REVIEW

February 23, 1945

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ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVI. No. 3509. FEBRUARY 23, 1945 9d. WEEKLY

Electrical Trends

Advance in Plant Design

ALTHOUGH the normal balance of production in electrical factories was again disturbed last year as a result of concentrating attention on immediate war needs, there is ample evidence of activity on more normal lines, as our editorial columns have shown. Mention can be made here of only a few of the more striking features that illustrate trends in practice.

Beginning with generation: 3,000-RPM turbines of 60,000 and 50,000 kW are under construction for steam pressures up to 1,250 lb. per sq. in., with and without reheating. The upward limit of two-pole alternators has been raised to 60,000 kW in some hydrogen-cooled machines, and a fair proportion of the total in hand will have 33-kV stators. Among the smaller turbo-alternators a number of rail-borne mobile units have been ordered for the U.S.S.R. Numerous salient-pole alternators for water-power stations abroad are being built. No doubt as a result of war experience, turbo-electric propulsion of ships of up to 10,000 tons appears to be going ahead with the high steam conditions, for marine work, of 425 lb. per sq. in. and 760 deg. F.

Large Transformers for Russia

Three-phase transformers with outputs of 45,000 to 60,000 kVA for the 132-kV grid are by now a regular annual feature ; more of a novelty is a 120,000-kVA bank of single-phase units for a 242-kV system in Russia. At the other end of the scale are the small transformers that are being turned out in bulk for mobile radio transmitters. In switchgear, the most striking advance has been the development of air-blast circuit breakers for 132, 66 and 33 kV and an increase in the use of air-break switches at lower voltages; nevertheless the demand for oil-break switchgear is said to remain steady.

AC and DC Applications

Symptomatic of progress in mining methods is a large output of flame-proof AC switchgear, transformers and motors, although rectified DC has assumed prominence in connection with United States lease-lend equipment and battery trucks in the collieries. DC is also largely used in conjunction with Ward-Leonard sets for several large winders (although improvements in control methods have extended the sphere of AC for this duty) and also for the heavier rolling mills. For welding, DC appears to be restricted to portable generators, in view of the encouragement of AC welding by the Machine Tool Control on economy grounds. The claims of the DC motor for close speed variation are being extended by progress made in electronic control devices. In the field that DC has almost to itself, *viz.*, traction, inquiries received lately indicate probable post-war activity in railway electrification, as an earnest of which last year a repeat order was accepted, for locomotives from South Africa.

Important tendencies are exemplified in the number of motors which are being wound for 6,000 V and which in larger capacities, at any voltage, are being arranged for direct-on-line starting. Radio

frequency heating is proving commercially successful for certain purposes, X-ray crystallography is being increasingly used for routine tests and provision is being made for improvements in the electric boiling plate. Plant and apparatus in most of the categories referred to above and in many others unspecified have been exported, a large proportion being repeat orders; in many cases these are required to meet extreme climatic variations. The broad picture obtained gives an indication of resourcefulness and of flexibility and adaptability of workshop methods that augur well for a peacetime production to rival a great war record.

Fuel and Power

AMONG the many measures taken by the Government under the Defence Regulations was the establishment of the Ministry of Fuel and Power. By the nature of its creation this was a purely wartime expedient, although even before the war there were advocates of such a Ministry. Circumstances have been so adverse that it is not easy to judge whether the Ministry has been a success or not. At all events it is considered that the Ministry should be given a chance to prove its worth in peacetime and a Bill for this purpose has been introduced by Major Lloyd George, with the support of the Prime Minister and other members of the Government. The objects of the Ministry are said to be " the effective and co-ordinated development of coal . . . and sources of fuel and power " and to promote " economy and efficiency in the supply, distribution, use and consumption of fuel and power." The Bill comes up for second reading to-day (Friday) and an interesting debate should result.

War-emergency Stations

LIKE Castle Meads station, Gloucester, which we described a fortnight ago, Earley station was designed specifically to meet immediate war needs. Both were built in about half the time normally taken, despite acute shortage of labour and materials. The setting to work of Earley was greatly facilitated by the public spirit of the South African Electricity Supply Commission in foregoing its claim on the first generating unit. Another distinctive feature of Earley is that it is the only station to be built and owned by the Central Electricity Board, for which it is operated by Edmundsons. From particulars given in this issue it will be clear that the term " war-emergency " can bear a meaning that is in no sense derogatory.

AC System Maintenance

THE paper presented by Mr. R. C. Hutton and Dr. J. McCombe before the I.E.E. Transmission Section offered an opportunity (of which advantage was taken in a good discussion) for designers and operators of electrical equipment to become further acquainted with each other's experiences. It should also help operating engineers in other undertakings to establish some standard of performance and for that purpose the analysis of faults and the steps taken to correct them are valuable. Since maintenance aims at preventing faults, some method of establishing a criterion of efficiency, such as that expressed in the case of protective gear by percentage of correct functioning (if only it were feasible), would establish a much needed basis for comparison.

Restrictions in Argentina

IT is not only the countries involved in the war which are experiencing a shortage of power. Remote Argentina is said to be suffering from reduced output as a result of dependence upon inferior fuels; the demand has inincreased by 30 per cent. during the war period. There has been a prohibition upon the use of electricity between the peak hours of 6 and 10 p.m. (a peak period which indicates that the industrial load is not predominant) and appeals for economy are being made. As it is still summer in Argentina the restrictions should not cause much distress at the moment.

Personal Touch

IN last week's Commons debate on local government Mr. Messer said that with a larger unit there was a danger that the authority might be far removed from the people. He expressed the opinion that this did not matter so much with regard to social services " such as gas, water, electricity and so on." It has been an important argument against the formation of too-large electricity distribution authorities that they would be unable to keep in sufficiently close touch with the consumers whom they served. With due deference to Mr. Messer, this does matter a great deal.

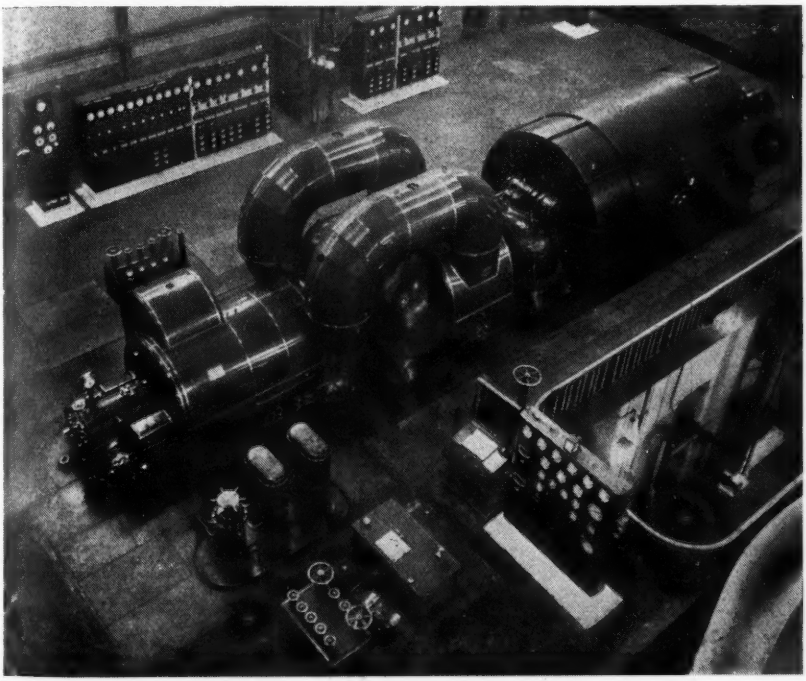
Earley Power Station

The C.E.B. Generating Station Near Reading

ON a site adjacent to the existing grid substation near Reading and between the G.W.R. main line and the River Thames, Earley power station was constructed as part of a war-emergency generating plant programme. Work was started on January 1st, 1941, and the station went into service in December of the following year with a 40,000-kW turbo-alternator and three 200,000 lb. per hr. pulverised - fuel - fired boilers originally ordered for the Congella station of the Electricity Supply Commission of South Africa. Steam conditions are 635 lb. per sq. in. and 850 deg. F. All coal is rail-borne and is fed by tippler into a pit, whence it is discharged to the station or to a drag-scraper store.

In 1942, the decision was taken to install a further turbo-alternator and two more boilers of the same output; this extension is nearing completion. Work has also begun on the final extension to bring the total capacity up to 120,000 kW in 1946.

The boilers, which have individual economical outputs of 160,000 lb. per hr., are of the modified tri-drum type made by International Combustion, Ltd., with a further drum at the lowest point of the circulatory system. Each boiler proper has a heating surface of 7,465 sq. ft., with 2,507 sq. ft. for the furnace, 9,300 sq. ft. for the superheater and 8,640 sq. ft. for the economiser. The pendant superheater comprises two primary sections at the sides of the boiler and two secondary sections in the centre; in between the primary and secondary sections is an automatic de-superheater. The economiser is of the twin-tube type with steel tubes having shrunk-on cast fins. Both air heaters are of the plate type and they have heating surfaces of 10,710 sq. ft. (high temperature) and 35,640 sq. ft. (low

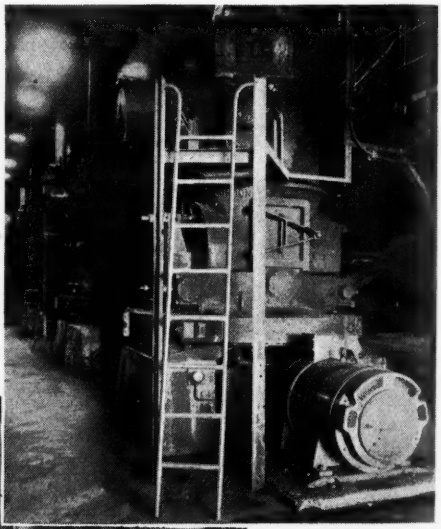


The station at present has a main plant capacity of 40,000 kW in one unit

temperature). The combustion chamber has a volume of 10,000 cu. ft.

The feed-water temperatures are : At economiser inlet, 340 deg. F.; at economiser outlet (estimated), 394 deg. At the maximum continuous output of 200,000 lb. per hr. the estimated temperature of the air leaving the low-temperature heater is 364 deg. and leaving the high-temperature heater 504 deg. while the air pressure at the burners is 2·5 in. w.g. Equivalent figures for the most economical rating are 353 and 485 deg. F. and 2 in.

At the economical output the guaranteed boiler efficiency is 91 per cent. (based on net calorific value) when burning South Wales bituminous small coal of a volatile content of 27 per cent., a gross c.v. as fired of 12,800 BThU per lb. and containing not more than 15 per cent. of ash or 12 per cent. of moisture. With South Wales semi-bituminous small coal of not less than 11 per cent. volatile, the designed efficiency is 89 per cent. The original design had to be modified for two-shift operation with fuel of lower volatile and higher moisture contents than those for South Africa. Combustion-chamber temperature was raised by increasing the spacing of the 3¼-in. (o.d.) water-wall tubes to 5⅜ in., thus exposing a greater area (2⅛ in.) of refractory; a refractory belt covering the wall tubes for a depth of 7 ft. 3 in. in the burner zone was incorporated to promote ignition; an additional heater was also interposed between the economiser and boiler outlet.



Above : The boilers are served by roller-type p.f. mills on the direct principle; two mills per boiler

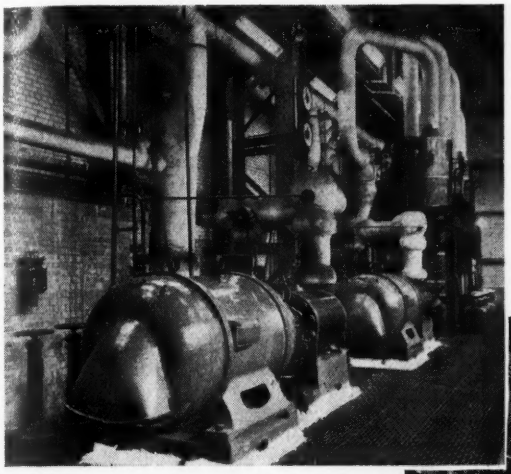
Left : Each boiler is operated from a central control board and desk at the firing-floor level 24 ft. above the basement ; immediately behind each board are the fuel feeder fans ; chutes serving raw coal to p.f. mills also shown

Two induced- and two forced-draught fans are installed per boiler. They are driven by two-speed squirrel-cage motors and the i.d. dampers are automatically regulated to maintain a pre-set furnace pressure of about 0·2 in. w.g. below atmospheric; the control system is air-actuated at 30 to 40 lb. per sq. in.

For each boiler there are two sets of pulverised-fuel equipments on the unit principle without intermediate storage; these comprise coal feeder, Lopulco roller pulveriser, separator and coal fan. Each mill has a capacity of 13,200 lb. per hr. with 6 per cent. moisture and 10,950 lb. with 15 per cent. moisture. While the mills themselves run at constant speed, the feeders and separators have variable speed DC drives and the exhauster fans variable speed AC drives, all controlled from the boiler instrument panel. The burners are set at an angle in each corner and round them are the secondary-air ports; tertiary-air ports are set higher in the furnace.

Modifications in the lighting-up arrange-

ments were called for, in order to use a creosote-pitch mixture instead of the light petroleum originally intended. This mixture



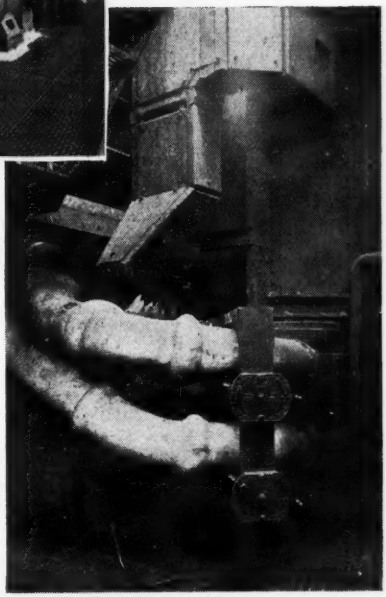
The boiler feed pumps and the h.p. feed heaters are located in the turbine room in line at the operating-floor level

does not flow freely below 90 deg. F. and above that temperature it tends to deposit free carbon unless kept in motion. For combustion the temperature has to be over 140 deg., but carbonisation in the pipes may occur at over 200 deg. The storage tanks are, therefore, fitted with thermostatically controlled heaters and circulation is constantly maintained in a ring main by pumps. The pipe work is wrapped with Pyrotenax heating cable divided into sections, each with separate thermostatic control set at 90 deg., and is lagged overall. Terminal heaters with thermostatic control, adjustable between 120 and 220 deg. F., are fitted before the burners.

Soot blowing is by means of superheated steam at full boiler pressure. Three types of electrically operated blower with automatic sequence are employed — single-nozzle retractable, multi-jet rotating and multi-jet traversing. Flue gases are taken at low velocity to a Sturtevant electrostatic precipitator (one to each boiler), for which an efficiency of 96 per cent. at m.c.o. is guaranteed when burning low volatile fuel. Ash and dust are dealt with by a Babcock and Wilcox plant in two sections both operated by high-pressure water supplied from a single pumping source.

The Parsons 40,000-kW turbo-alternators run at 3,000 RPM and operate with stop-valve steam conditions of 615 lb. per sq. in. (gauge) and 815 deg. F. At the most economic rating of 32,000 kW, the vacuum at the exhaust flange is 28·7 in. Hg. (Bar. 30) and the final feed temperature 340 deg. The turbines are two-cylinder reaction machines with thirty-eight stages in the high-pressure portion and six in each of the two steam paths of the double-exhaust low-pressure cylinder.

The exhaust of the l.p. cylinder is taken to a single two-pass condenser with a surface of 30,000 sq. ft. The set now installed has a quick-starting ejector and a two-stage running ejector; the other two will have stand-by running ejectors also. Since the inlet temperature of the circulating water would have been 72 deg.



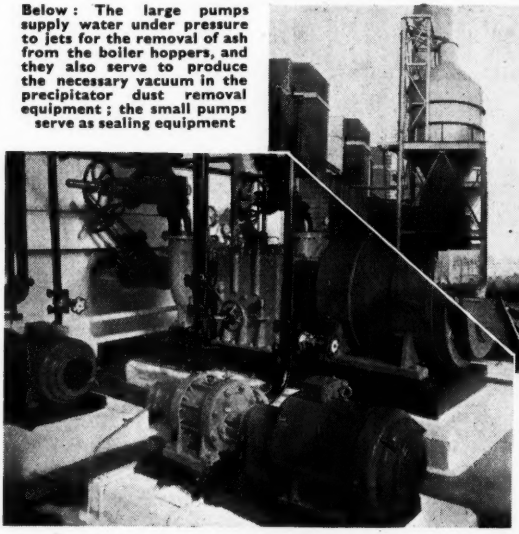
Each boiler is fed on the corner-firing principle; under the main burners is shown the starting-up oil burner, and the ducting for the tertiary air is seen above

F. in South Africa and the vacuum at economical load 28·5 in., whereas the normal temperature at Earley is 55 deg. F., some of the tubes were omitted and a smaller circulating-water pump was installed.

Cooling water is drawn from the Thames through an open canal and returned to the river half a mile down stream through an underground reinforced-concrete culvert. Debris is excluded by means of a wooden

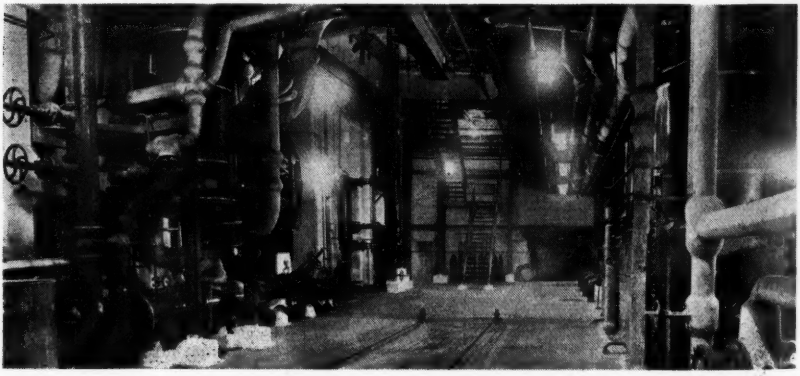
grille at the intake to the pump house and by rotating self-cleaning band screens inside. One vertical-spindle 22,000 gal. per min. axial-flow pump serves each turbo-alternator.

Duplicate vertical-spindle extraction pumps deliver the condensate through ejector coolers, drain cooler and a single l.p. feed heater to the feed-pump suction main at 194 deg. F. at m.c.r. Three h.p. heaters on the discharge side of the feed pumps raise the temperature to 356 deg. Two bled-steam evaporators are jointly capable of evaporating 4 per cent. of make-up water; these operate on the pressure and temperature difference across the two highest bled-steam tappings, the second h.p. heater acting as vapour condenser. When the evaporators are in use they are fed direct with bled steam in place of No. 2 h.p. feed-water heater which, in turn, is fed from the evaporator. In line with the h.p. feed heaters in the turbine room are two electrically-driven and one steam-driven Weir feed pumps designed for a total pressure of 850 lb. per sq. in. for the first set and one electric and one steam for the second, any of them is able to deal with one turbine.



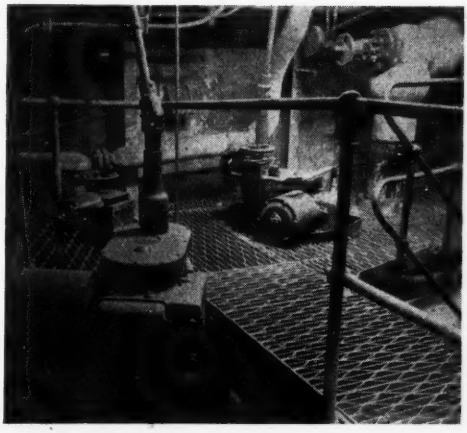
Below: The large pumps supply water under pressure to jets for the removal of ash from the boiler hoppers, and they also serve to produce the necessary vacuum in the precipitator dust removal equipment; the small pumps serve as sealing equipment

Above: The main flue (left) is outside the station, and between this and the coal-handling plant are the cyclones for collecting flue dust; behind the flue are the electrostatic precipitators



The l.p. heaters (left) and the single-effect twin evaporators (right) are situated in the condenser basement

The two-pole alternator, which generates at the switching voltage of 33 kV, has a rated continuous output of 40,000 kW at 0·85 power factor. The alternator rotor is a one-piece forging, weighing 97 tons, exclusive of the end shields, and



The main electrically operated feed-water valves are at the level 56 ft. above the basement; automatic feed-water regulator on right

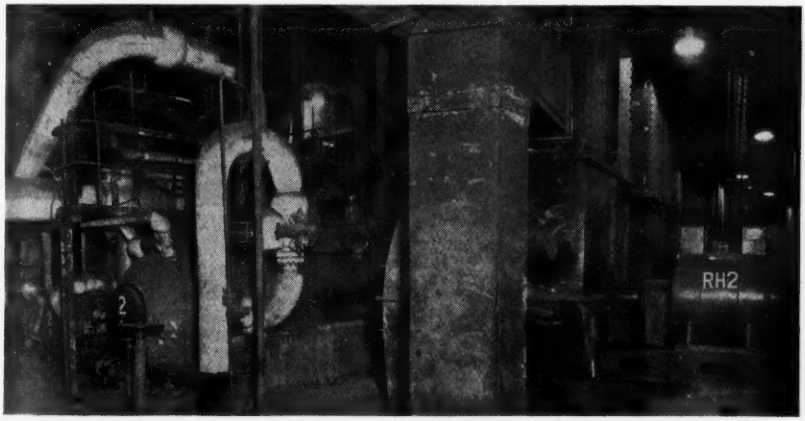
it is the heaviest single item of plant in the station.

The 33-kV generator switchgear is Reyrolle's horizontal draw-out metal-clad compound-filled type with a rupturing capacity of 500 MVA. This is accommodated at the grid substation on the opposite side of the railway, where main switching is performed, an emergency control panel only being provided in the turbine house. Merz-Price protection has been adopted for the alternator and earth-leakage protection for the direct-connected unit auxiliary transformer, with back-up over-current relays. Operation of any of these relays trips the main circuit-breaker, field-suppression switch, emergency steam stop valve and the 3·3-kV circuit-breaker of the transformer.

Power for auxiliaries is supplied from a 3,000-kVA 33/3·3-kV unit transformer solidly connected to the terminals of each alternator or from two 5,000-kVA station transformers teed off the 33-kV side of the 132/33-kV grid transformers. The 3·3-kV switchgear, which is controlled from the turbine room, is of the air-break draw-out electrically operated type and of 75-MVA rupturing capacity. The 400-V switchgear is generally similar, but has rupturing capacities of 25 or 15 MVA and some of it is hand-operated.

Auxiliary motors are generally of the squirrel-cage type protected by earth-fault indicators and phase-to-phase fault tripping only. A large part of the illumination of the station, which has restricted natural lighting, is done by fluorescent discharge lamps and Pyrotenax cable is used extensively.

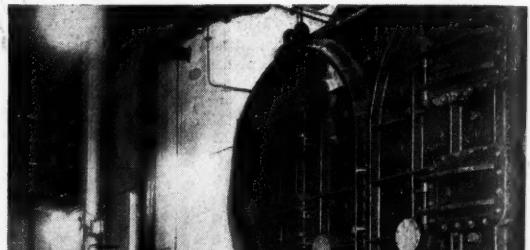
During the week ended February 3rd Earley power station generated on three-shift operation 5·6 million kWh of which 6·09 per cent. was used on works. This entailed a consumption of 2,522 tons of coal of 12,590 BThU per lb. and 7·3 tons of



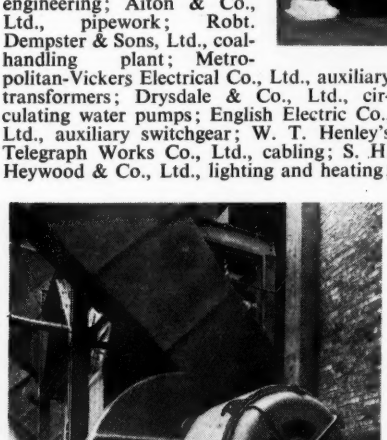
The f.d. fans are at the same level as the steaming drums, *i.e.*, 63 ft. above basement level

creosote-pitch (for lighting up three boilers), giving 1·009 lb. per kWh generated and 1·075 lb. per kWh sent out, equivalent to 25·21 per cent. thermal efficiency. The coal had a volatile content of 19 per cent. moisture 8·4 per cent. and ash 9·8 per cent. Only 0·978 per cent. of make-up water was required.

The consulting engineers responsible for the design and construction of the station are Messrs. Merz and McLellan, for whom Sir Alexander Gibb and Partners acted in connection with the civil engineering work. Contractors not previously mentioned included the following: — Sir Robt. McAlpine & Sons, Ltd., civil engineering; Aiton & Co., Ltd., pipework; Robt. Dempster & Sons, Ltd., coal-handling plant; Metropolitan-Vickers Electrical Co., Ltd., auxiliary transformers; Drysdale & Co., Ltd., circulating water pumps; English Electric Co., Ltd., auxiliary switchgear; W. T. Henley's Telegraph Works Co., Ltd., cabling; S. H. Heywood & Co., Ltd., lighting and heating; Bryce, Ltd., lighting and heating transformers; Foster Transformers & Switchgear, Ltd., lighting transformer; Clifford & Snell, Ltd., Loudaphone and total-load indicating equipment; Clarke, Chapman & Co., Ltd., coal-truck capstan.



The condensate is handled by two 100 per cent. duty motor-driven vertical extraction pumps



The i.d. fans are outside the station building, almost under the main flue

Screw-thread Chart

MUCH tedious calculation and valuable time can be saved by consulting a wall chart of Freeman's screw thread and engineering tables. This provides essential data on B.S.W., B.S.F., B.S.P. and B.A. screw threads, including pitch and depth; major, minor and effective diameters; B.S.I. tolerances; three classes of fit for tapping and clearing drills with corresponding thread-depth percentages; also a full list of standard drills, indicating their fractional, number, letter and size classification from No. 80 to 65 mm. with decimal equivalents; besides rates of speed and feed, formulae, constants, S.W.G. sizes and circle-spacing data for from one to twelve holes.

Apart from the usual information this chart provides comprehensive original data; for instance it shows that no tapping drill of any standard size will cut more than 85 per cent. of the full depth of a $\frac{1}{4}$ in. B.S.F. thread; that 0·5372 in. is the correct size to bore or make a special drill to form 95 per cent. of the full depth of a $\frac{1}{4}$ in. thread. It indicates that twelve different standard size drills arranged in three classes of fit may be used as tapping sizes for $\frac{1}{4}$ in. B.S.W. thread; the proportion of the full thread depth that each of those dozen drills will cut; the amount by which each drill exceeds the minor diameter of the thread (expressed in inches) correct to four decimal places; and, finally, how that amount compares with present B.S.I. tolerances. Blue prints of the chart, measuring 50 by 40 in. are obtainable (10s. 6d. each) from Euco Tools, Ltd., 11, Bedford Square, W.C.1.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Force Between Parallel Conductors

IN your issue of January 19th, Professor Howe draws attention to simple proofs that the formulæ for the force F and the inductance L between parallel cylindrical conductors are equally valid for both distant and close spacing, providing that the current distribution is cylindrical or annular.

For a loop carrying a current i E.M.U., if the axial separation of the conductors is x cm., it is easy to prove, either from the energy relationships or by direct differentiation of the inductance formula, that $F = \frac{i^2}{2} \cdot \frac{dL}{dx}$ dynes per cm., L being measured in cm. per cm.

Since F and L are thus rigidly connected, it is sufficient to show that *either* the force formula *or* the inductance formula is valid for close spacing. The corresponding validity of the other formula may then be at once inferred without further discussion.

It is well to note that this validity does not extend to stranded conductors, for which the lines of force in the immediate vicinity of the strands are crinkled. However, the error introduced by assuming an "equivalent" circular section is usually very small.

West Ham Municipal College. G. F. FREEMAN.

Motor Single-phasing

REFERRING to the review in your issue of February 9th of the paper on "Motor Control Gear" read by Mr. D. Rudd before the I.E.E. Installations Section, we noticed the statement to the effect that there is a real need for an inexpensive phase-failure relay that is reliable for large motors. Actually a device, which is inexpensive and gives positive protection against single-phasing entirely independent of the overload trip setting, has for many years been included as a standard fitting on polyphase motor-control gear of all types and sizes.

We are a little surprised that the need for anti-single-phasing protection is stressed for large motors, for our experience is that whilst this is very desirable it is even more important for smaller motors. We agree that fuses are a very common cause of single-phasing (although by no means the only one) and that even if circuits are correctly fused, they remain a source of trouble, especially the rewirable type, due for instance to the wire being nicked or otherwise damaged when being fixed to the fuse terminals, and this factor is emphasised in the smaller sizes.

We have always thought that the reason why in our experience single-phasing troubles have shown up more in the smaller machines than in the larger ones is that in the former case everything associated with the installation is on the light side and therefore more liable to become out of adjustment and be less able to withstand general abuse. As a result we have found it desirable to produce anti-single-phasing motor-control gear specifically even for fractional-horse-power motors.

St. Albans. ELECTRICAL APPARATUS CO., LTD. A. V. LAWRY, *Director.*

I.E.E. Graduates' Position

THE spate of recent letters show that disillusioned graduates have a legitimate grievance. By allowing the ventilation of these your correspondence columns are performing a real service. If a census were taken of graduates who were unable to make use of their qualifications the figures would be startling. Sir Harry Railing, in his I.E.E. presidential address, stressed the great responsibility which electrical engineers have towards society. This can only be met if the best types are attracted to our industry.

At the moment the force is one of "repulsion." Many talented young engineers with real ability and sufficient vision to devote five or six years' evening slogging for the Higher National Certificate reach an impasse and are driven away. Or if they remain, accept the inevitable and—vegetate. It seems to me that the Council of the I.E.E. has a social responsibility for taking a census as noted above and using its influence to prevent such fine human material from being wasted. Undoubtedly these endeavours would pay handsome dividends for the future of electrical engineering.

A FURTHER GRADUATE.

Supply Industry Unification

THE criticisms by "Buscome" in your issue of February 9th of my article on "Electricity Supply Unification" afford an opportunity to remove a number of misapprehensions. In the first place it is Parliament which has called for the situation to be re-assessed—not the industry itself or interested busybodies. Whether Parliament ought to have commenced on some other issue, or not, is quite beside the point. The various electrical associations were compelled to respond to the Ministerial request for their views and since these are far from unanimous every citizen should investigate the position, with a view to making recommendations to his M.P.

So far as I am aware, no one else has pursued the subject to its logical conclusion,

viz. the price per kWh. In my article I expressly asked the reader to alter any details in my financial argument to suit his own views and then see how effective the result would be, but " Buscome "—like the nine reports—does not do so.

Paragraph 8(b) of the Joint Memorandum of April, 1944, states: " Unless it can be proved that consumers will derive substantial and permanent benefit thereby the ownership and organisation of existing undertakings shall not be subjected to drastic alteration." It follows that the Joint Committee would, under certain conditions, support drastic changes, but it left the situation in the air.

Electricity now averages about 1d. per kWh whether supplied by a company or public authority, so there is no foundation for the remarks in " Buscome's " second paragraph. The table in my article was based on a stationary condition of the industry for the sole purpose of making the difficulties a maximum. Changes in working costs clearly apply to any organisation, as does the strain caused by extensions into less remunerative areas.

My " then-value " and " depreciation " figures are the result of patient calculation and are not biased in favour of the buyer. As regards extended depreciation, undertakings or parts of undertakings have been purchased on many previous occasions without noticeable worry on this score on the part of the purchaser. Moreover, conversion loans have recently been quite popular. " Buscome " is on firmer ground when it comes to income tax, but surely it would be a small thing for Parliament to grant this freedom compared with a decision to unify the industry.

What use would it be to buy undertakings from municipalities on the same basis as from companies? It does not seem sensible to make municipal *electricity consumers* pay twice over for a portion of their capital commitments. The fundamental difference is that municipal undertakings belong to the consumers, whereas company undertakings belong to certain private individuals. In regard to reserve funds, " Buscome " apparently considers that consumers ought to be overcharged for many years on the off-chance that the reserve may keep prices stable during a war. A nation-wide organisation can carry its own insurance risks. In other words the £4,000,000 " hidden reserve " would enable the effects of a disaster—such as a burnt-out power station—to be staved off without any appreciable effect on the price per kWh.

The rationalisation saving of £2,000,000 was purposely an under-estimate. Surely one could not reduce the tariffs in over 400 undertakings without improving one's turnover tremendously—and this is only one instance. The franchise saving of £1,500,000 is simply a matter of multiplication. As the Parliamentary Secretary to the Treasury recently stated that the proposed interest rate for thirty-year periods would be 3 per cent. for local authorities, my estimate in this respect was very near the mark.

Because I worked out the minimum saving for a successful issue, " Buscome " accuses me of advocating many things in connection with tariff changes which my article did not even discuss, but a reduction of £2,000,000 per annum (7 per cent.) in the cost of power supplies can hardly be considered a grim outlook for industry! Finally, he suggests that I failed in my effort because the savings which could be fully documented amounted only to £7,000,000 instead of the target of £9,000,000. However, I would be quite content to let electricity consumers (*i.e.* the whole electorate) give a decision on whether they would like a 7 per cent. reduction, even if 9 per cent. were not attainable.

Wolverhampton. J. L. FERNS.

Trinidad Services

Electricity and Transport

A NUMBER of major works were carried out by the Trinidad Electricity Board during 1943 and are described in the Board's annual report which we have received from the general manager, Mr. W. J. Williams, M.I.E.E. A second 2,500-kW Nordberg Diesel unit ordered from the United States the previous year was put into commercial use on July 4th, 1943, just under two months after erection was started. A 5,000-kW steam turbine set was ordered from England and in July a consignment of materials arrived for two 60,000 lb. per hr. Babcock & Wilcox boilers. Considerable difficulties were encountered in the construction of the foundations for these boilers, the subsoil being very poor, necessitating some piling. Reconstruction work was carried out at the old fresh-water ponds at the power station and salt water is now pumped up at the dockside by two vertical radial pumps electrically operated from the power station.

In spite of restrictions on the use of electricity for domestic and private purposes sales rose from 15·2 million to 19·9 million kWh, an increase of nearly 31 per cent. Revenue per kWh sold dropped from 5·364 to 4·984 cents and expenditure from 4·516 to 4·381 cents. The net profit for the year was $151,079 (against $159,963). Following a decision by the Board to recommence the connection of new premises there was an increase in installation work and this department recorded a profit of $12,427 against a loss of $5,130.

Increased traffic was carried by both trams and trolley-buses, but fewer passengers were transported by the motor-buses many of which were laid up owing to difficulty in obtaining spare parts. The tramways produced a surplus revenue of $26,580 (against $25,579) and the trolley-buses a profit of $35,568 (against a deficit of $10,327), while there was a loss on the motor-buses of $71,426 ($37,952 deficit in 1942).

PERSONAL and SOCIAL

News of Men and Women of the Industry

AMONG those upon whom the King conferred the honour of knighthood at Buckingham Palace on February 13th were **Dr. A. P. M. Fleming** and **Alderman W. Walker,** whose names appeared in the New Year Honours List.

Mr. H. C. Pierson has retired from his position as general sales manager of the Metropolitan-Vickers Electrical Co., Ltd., but retains his seat on the board. **Mr. Ivor R. Cox,** who succeeds him, also retains his present position as managing director of the Metropolitan-Vickers Electrical Export Co., Ltd. **Mr. Duncan MacArthur** has been appointed deputy general sales manager, retaining his present position of home sales manager. He has also been elected to the board of the Metropolitan-Vickers Electrical Export Co., Ltd.

Mr. V. J. Radbone has been elected a director of Associated Electrical Industries, Ltd. He is, *inter alia,* London representative of the International General Electric Co.

Mr. F. Overstall, A.M.I.E.E., deputy electrical engineer and manager at Paisley since 1941, has been appointed to a similar position at Peterborough. He received his technical education at the Manchester College of Technology and served an apprenticeship with the Rawtenstall electricity undertaking, where he was later in the generating, meter and mains departments. Following service at Aylesbury and with the Northampton Electric Light & Power Co., Ltd., he went to Birmingham in 1930 as mains assistant and five years later was promoted chief assistant for the Solihull district. In 1939 he joined the Birkenhead undertaking as mains superintendent, going from there to Paisley.

Mr. F. Overstall

The annual luncheon of the Electrical Trades Commercial Travellers' Association took place at the Connaught Rooms in London on Friday last. It was the sixth of the series, and **Mr. Marks** took the opportunity of presenting a handsome gavel, suitably inscribed, to the chairman as an emblem of power while in office. **Mr. J. G. Edwards** accepted the hammer with thanks on behalf of the Association.

The toast of " The Association " was proposed by **Mr. Carlton Dyer,** who referred to his travels in Canada and other parts of the world on behalf of the Allied Nations and expressed his pleasure at the muster of 460 members and guests. **Mr. W. F. Moir** (president of the Association) responded and expressed the hope that with better times to look forward to an endeavour would be made to do something more than merely keep their employment register up to date; the provision of better and more employment for members was a worthy object to strive for. He also announced that assistance would be welcome towards the cost of sending parcels to members serving in the fighting forces.

Mr. Johnson then made his customary statement in respect of the benevolent fund, while the charity steward's appeal resulted in the record table collection of £65.

The health of the guests was proposed by **Mr. B. E. Crow** and **Mr. C. Hughes** responded. The health of the chairman was proposed by **Mr. F. W. Wheatley** and in his acknowledgment Mr. Edwards read a letter from Sir Harry Railing, conveying good wishes and regrets for his unavoidable absence.

In a report which the St. Pancras Borough Council approved in 1943 it was pointed out that it might be desirable at some future time, in view of post-war developments, to consider the appointment of a deputy engineer and manager of the Electricity Department. The Electricity Committee now considers that this appointment should be made and recommends **Mr. W. J. Lee,** A.M.I.E.E., for the position at a basic salary of £900 per annum, plus cost-of-living addition. Mr. Lee, who has been with the undertaking for forty-one years, is at present power station superintendent, having been promoted from meter superintendent in November, 1940. It is proposed that he should continue to be responsible for the supervision of the power station.

Mr. Walter C. Mountain, manager of the Melton Mowbray Electric Light Co., is retiring from this position in May next. He has been associated with the company first as secretary then as manager for forty-two years, thirty-eight of them in his present position. His successor will be **Mr. C. E. Wood** who for nineteen years has managed the Stamford undertaking of the Urban Electric Supply Co.

Mr. H. G. Hagon a director of Taylor, Taylor & Hobson, Ltd., Leicester, has just completed fifty years' service with the company. To celebrate the event the company's " 25 " club held a dinner in the works canteen. On behalf of the directors and employees Mr. Warmisham made a presentation to Mr. Hagon, and Miss A. M. Perkins one to Mrs. Hagon. Presentations were also made to **Mr. G. Stafford,** who retired from the directorate last year, and **Mr. E. Oram,** who was sales manager to the company until his recent resignation.

Mr. H. Cecil Booth has relinquished the position of joint managing director of the British Vacuum Cleaner & Engineering Co., Ltd., on account of advancing years, but will remain chairman of the company of which he has been a director since its inception. **Mr. J. J. Hambidge** will now become sole managing director and **Mr. D. Watkins** will still be assistant managing director.

The Metropolitan-Vickers Dramatic and Operatic Society has again achieved a notable success, the play in this case being " Distinguished Gathering," by James Parish, given recently at the Metropolitan-Vickers Club Theatre to crowded houses on four nights.

Among those present was Sir Thomas Robinson, the Charter Mayor of Stretford, with the Mayoress. As the result, the Society was asked to repeat the four performances in aid of local funds for Services at Sale Town Hall, where the players were given an enthusiastic reception and were thanked by the Mayor.

Mr. L. H. Saynor, power station superintendent with the Gravesend Corporation Electricity Department, has been promoted to the position of power station superintendent and assistant engineer.

Mr. Harry Green, who recently retired from the service of Standard Telephones & Cables, Ltd., had a long and varied career in the telecommunications industry. In 1896 he commenced his apprenticeship with the National Telephone Co. and in 1901 was appointed cable inspector with the Glasgow Corporation

Sir Frank Gill (right) making a presentation to Mr. H. Green

Telephone Department, afterwards becoming mains superintendent. In 1904 he returned to the N.T.C. as cable engineer and in 1913 he joined Gill & Cook, consulting engineers, as plant engineer, a position which he held until 1919, having during this time served for two years with Army Signals as O.C. Construction Unit. Towards the end of 1919 he joined the Western Electric Co. as cable superintendent and in 1928 he became director of installation with the International Standard Electric Corporation, London. In 1930 he transferred to Standard Telephones & Cables, Ltd., as director of installation and from 1934 to 1944 he held the position of general liaison officer in charge of the co-ordination of trunk and toll cable schemes for Standard Telephones & Cables, Ltd., and United Telephones (B.I. and Southern) in conjunction with Post Office officials. At a farewell luncheon Sir Frank Gill presented Mr. Green with a cheque and an autographed card.

Mr. T. M. Birst, who has been chief installation inspector with the Edinburgh Corporation Electricity Department since 1912, was recently the guest of honour at a function in the Chamber of Commerce Rooms. Councillor J. B. Mackenzie, president of the Edinburgh Branch of the Electrical Contractors' Association of Scotland, presented to him a wallet of notes and an address on parchment as a token of the Association's esteem.

Mr. R. I. Kinnear, M.B.E., chief electrical engineer of John Brown & Co., Ltd., Clydebank, has been nominated as chairman of the Scottish Centre of the Institution of Electrical Engineers for 1945-46. The vice-chairmen nominated are **Mr. H. M. Speirs,** B.Sc. (H. M. Speirs & Co., Glasgow) and **Mr. J. Gogan** (development superintendent, Clyde Valley Electrical Power Co.).

Mr. J. F. Peaker, mains superintendent and assistant manager with the Chesterfield Electricity Department, is retiring in April. He joined the undertaking in 1919 as mains superintendent and became assistant manager in 1928. In 1942 when he was due to retire he was reappointed for a further term of service.

Lord Brabazon, writing on the Severn Barrage scheme in *Electrical News & Engineering* (Toronto), says that Great Britain can lead the world in tidal power if the scheme is put in hand, as he hopes and believes it will be in the near future.

Obituary

Mr. D. Weir.—We regret to announce the death at his home on February 12th, of Mr. David Weir, who had represented the B.T.H. Co. for several years on various sections of the British Electrical & Allied Manufacturers' Association, and the International Electrical Association. Mr. Weir was born at Dunfermline in 1888, and educated at Dunfermline High School and Glasgow University, where he received the B.Sc. degree. Before entering the University, he had some years training with, among others, the British Electric Plant Co., Ltd., and the Fife Electric Power Co. After leaving the University he joined the B.T.H. Co. with whom—except for four years in the Forces during the last war—he remained. Starting in the Testing Department at Rugby, he went to the D.C. Design Engineering Department, and then joined the Contract Department, under the late Mr. J. P. Gregory, where he specialised in mine winders and read a number of papers on the subject before technical societies.

He eventually became manager of the Plant Sales Department, but after a breakdown in health, he was transferred to the General Sales Management for special duties, becoming B.T.H. representative on the B.E.A.M.A. and I.E.A. Mr. Weir leaves a widow to whom we offer our sympathy.

Mr. H. M. Ash, who has died at Brighton at the age of ninety-four, was a draughtsman by profession and spent his working career with Siemens Bros. & Co., Ltd. He was associated, as a hydrographer, in the laying of the 1894 Mackay-Bennet Atlantic cable and made a number of transatlantic voyages in connection with this task. He retired in 1910.

Mr. J. Bentley.—The death occurred suddenly on February 12th at his home in Glasgow of Mr. John Bentley, M.I.E.E. He was sixty-five.

Will.—Professor W. M. Thornton, Emeritus Professor of Electrical Engineering at King's College, Newcastle-on-Tyne, left £16,215 (net personalty £16,100).

Standard Voltage

The Case for Choosing 240 V

By Capt. J. M. Donaldson, M.C., M.Inst.C.E., M.I.E.E.

PERHAPS the commonest complaint of the general public in regard to electricity supply is the lack of uniformity of system and voltage. So far as system is concerned it does not matter to the ordinary consumer whether his supply, if alternating, is single-phase, three-phase (or even two-phase) although to the power user this is a matter of vital importance. Nor does it often make much difference to him whether he is on a DC or AC supply except (and this is a very large exception) so far as his wireless set is affected. However,

Capt. Donaldson is a director of the Northmet Power Co., of which he was chief engineer for many years and later general manager

it is about the declared voltage that this article is written. First of all, when complaints are made about different voltages in different districts, they almost always relate to the 100-V range, or possibly in some cases 200 V (which, however, is not very common in this country) and it is obviously impossible for people moving from a 100-V to a 230-V district or *vice versa* to use any of their apparatus.

Effect of Alteration

There can be no question that these lower voltages will eventually have to go, but it is not always appreciated that so far as the old standard voltages are concerned (there have been three, namely, 220, 230 and 240) there is not likely to be very much difficulty in changing over consumers if the step is only 10 volts.

Take the case of lamps—if the voltage is raised by 10, the lamps will be more efficient, but will last a shorter time. If the step is in a downward direction the reverse will be the case, but in any event lamps do not last for ever and any lamp troubles will clear themselves within a year or so.

The case of heating apparatus and particularly of radiant fires and cooking apparatus is, however, more difficult. Nevertheless, if one purchases a fire for, say, 230 V, in most cases the nameplate marking gives a range of 10 and sometimes 20 V, so that it seems fairly evident that in the event of one single voltage being established, there would not be a very great saving to the manufacturer with regard to stock sizes. For a 10-V change one need not anticipate considerable expense as regards fires. Although they have a much longer life than lamps, new and attractive designs are continually coming out and there is a tendency for the older types of fires to be put out of use long before they have burnt out. In the case of cookers, replacements of elements are not uncommon and a complete change is only a question of time.

A Logical Standard

The first thing to be considered is what is the most suitable standard voltage round about 230. The answer appears to be clear—it is 240 V. It must be remembered that the Electricity Regulations prohibit the use of anything higher than low voltage in a consumer's premises in the ordinary way. Low voltage is defined to be one not exceeding 250 V, but the tolerance of 4 per cent. then permissible* must not be overlooked and the addition of this tolerance, to 250V, would bring the voltage in the consumer's house to 260. This was definitely illegal until only a year or two ago when the Regulations were changed to cover this point. It seems to me quite fair to say that those undertakings which in the early days standardised at 250 V were not legally in order.

This seems to rule out 250 V. On the other hand, if you are going to adopt the 200- to 250-V range as used for many years in this country, then it seems reasonable to go as high as you can because a difference of 10 or 20 V is going to make no difference whatever to the safety (although this is really much more a talking point than anything else) while there is a very great difference in capital cost of transmission and distribution. These items as a rule represent over 50 per cent. of the cost of an undertaking with its own generating station. A 4 per cent. increase in voltage means a 4 per cent. increase in carrying capacity of the mains but, as in most cases the limiting feature is not carrying capacity but voltage drop, the actual advantage is much more like double this, because a percentage drop is reduced not by 4 but by 8 per cent.

The Standard Voltages

Very few people remember how and when standard electric pressures were arrived at by what is now called the British Standards Institution, but here are the facts. In the year

* Later increased to 6 per cent. in the Electricity Supply Regulations of 1937.

1904 the Engineering Standards Committee regularised a standard "low pressure" of 220 V for DC or AC at the consumer's terminals. How this figure was decided I do not know, nor have I met anybody who could tell me, but in 1921 a new specification was got out for new systems, when 220 V was standardised for DC and 240 V for AC. The reason was that at that time the metallic-filament lamp was being developed and the lamp manufacturers found some difficulty in making lamps to the exact voltage. They therefore suggested that economy would be served by having two separate voltages so that they could fit in their manufactures with less waste, and so it was that this somewhat extraordinary decision was reached. One cannot help thinking that the authorities might have had more confidence in the ability of the manufacturers to overcome this difficulty, which, of course, they did very soon and then they pleaded for a single voltage. As a consequence, in 1925 a B.E.S.A. publication, "British Standard Voltages for New Systems and Installations," was issued and a single voltage of 230 V was introduced for the first time.

I am afraid we must say that this was a typical British compromise—the mean figure was taken and the Committee was undoubtedly influenced by the fact that at that period there were, as there are now, considerably more installations arranged for 230 V than for any other.

I have sometimes heard people say, rather ironically, to the non 230-V undertakings that they were at fault in not making their voltage conform to "standard," I think it must be agreed that this would not have been a possible procedure for anybody.

In 1904 AC consumers would have had to be changed to 220 V, that is if some other voltage were in use. In 1921 the voltage would have had to be increased to 240. In 1925 it would have been reduced to 230. Obviously such a series of changes would have been impossible.

The Commissioners' View

In the next place it must be remembered that B.S. specifications are recommendations only and can be of practical effect only if they are put into operation by some body which is authorised to do so. In the case of the electricity industry, since 1919 the authority has, of course, resided with the Electricity Commissioners.

The Commissioners have always taken a realistic view of the situation, appreciating the difficulties in the way, and although they have specified 230 V AC for new areas, they have, generally, I think, adopted the line that where a large area is concerned it should be as homogeneous as possible. For instance, in the Northmet area with which I am connected, we standardised 240 V AC in 1907 for reasons outlined above, and obtained permission at various times for changing five undertakings in the area, which were at some time isolated, from 230 to 240 V, while in one case a reduction from 250 to 240 V was made and in yet another small area the voltage was raised from 220 to 240. Here I may say in passing that the last-named operation was carried out within a year without a penny-piece being expended on the consumers' apparatus and without, so far as I can now remember, a single complaint from any of those affected. Of course, the change was carried out gradually.

Therefore, of the four higher voltages, 220, 230, 240 and 250, 250 never was a standard and was of doubtful legality, and 240 appears to be the most logical figure to adopt.

Changing Over

It is worth considering what is involved in changing over a 230-V AC system to 240 V, or in changing down 250 to 240 V. In the former case the simplest method is to raise the voltage at the generating station by 5 per cent., which gives an advantage in increased capacity of the feeders from the station to the sub-transformers as well as in the distribution mains themselves. It is quite possible that in most cases the sub-transformers, as one may call them, could be used on the higher voltage without difficulty. Many supply authorities have specified that such transformers should be capable of standing a 10 per cent. increase of voltage continuously. A 5 per cent. increase would have the effect merely of increasing the iron losses and reducing the copper losses and consequently it seems unlikely that this would cause any difficulty.

On the other hand it might not be practicable to raise the voltage at the generating station, possibly because of connection with the grid, while the alternative of raising the voltage by tap changing on step-up transformers at the generating station might not be convenient. In this case it will generally be possible to keep the voltage unchanged up to the high-voltage terminals of the sub-transformers and to alter the tappings. These tappings are almost invariably on the high-voltage side and, therefore, it must be possible to *raise* the voltage on the lower-voltage side because it involves using fewer turns on the high-voltage side. The reverse process, that is to say, coming down, would not necessarily be possible (although in all probability it would) because there might not be, so to speak, sufficient primary turns to enable the distribution voltage to be lowered.

It is not advisable to dogmatise on these matters because there is a very considerable difference between undertakings, not only because of their technical arrangements, but mainly because of the different lengths of

transmission and the corresponding variations in the arrangement of transformers.

In some cases in my knowledge a secondary or intermediate high-voltage system is used and there are no tappings on the sub-transformers connected with this part of the network, but there are regulators of various types which vary the voltage on the feeders. In such a case it is simple to deal with a small change such as 10 V even if, in extreme cases, regulators have to be rewound or replaced.

One further point I should emphasise is that 100-V systems would have to be varied in any event and there is no question whatever of varying generator voltages or altering tappings unless by chance the sub-transformers happen to be double-wound, so that they could be used either at 115 or 230 V. Where, however, this is not possible it seems logical to take advantage of the change to increase very considerably the capacity of the high-voltage feeder system.

I think it will be found that all h.v. cables installed more than 10 or 15 years ago could safely be used with a voltage at least 20 per cent. higher than they at present carry, at any rate cables up to 11,000 V, and if new transformers had to be ordered in any case it would appear to be a wise proceeding to raise the feeder voltage at the same time.

In general my own personal feeling is that 240 is the only logical voltage, and in any event the voltage was standard at one time. Those who use 250 V have not got a very strong case for retaining this and in any case changing down to 240 V is simple and probably inexpensive. Changing up from 220 or 230 to 240 V gives considerably increased value to the distribution; that is to say, it postpones the time when extensions to the network have to be carried out or new substations installed and this is a continuing gain since, as the system grows, so will the saving in distribution expenditure continue.

In my personal opinion, for a 10-V or even a 20-V change the expense of adapting consumers' apparatus is not likely to be high, and I further believe that a change of 10 or 20 V, if carried out in suitable small steps, could be effected without the large majority of consumers even noticing the change.

Trade with France

Information from the D.O.T.

BELIEVING that liberated France should provide a considerable market for the products of its members, the Gauge and Tool Manufacturers' Association has put a number of questions to the Department of Overseas Trade whose replies are of general interest.

The Department says that it has not yet proved possible to arrange for private trade between British and French industrialists. Various factors and, in particular, transport make it essential for imports into France to be subject to planning and inter-Governmental machinery for the time being. The French have prepared lists of immediate requirements which at present are largely raw materials plus a certain amount of technical equipment for, *e.g.*, public utility services. These immediate needs are being dealt with through Allied planning machinery in London and Washington. In the meantime, it is suggested that the Association should make contact with the French Supply Mission and the Mission of the French Ministry of Industrial Production in London, which will be responsible for deciding what France is to buy from Great Britain. The French Purchasing Commission is creating a catalogue library of the products of United Kingdom firms desirous of supplying goods to France.

There is no objection to sending catalogues overseas, but at present the postal services to France are limited to postcards and business letters not exceeding 1 oz. in weight. No registered letters, insurance or express delivery, and no air-mail, money orders or parcel post services are at present available. The Government is making every endeavour to have these facilities improved as soon as possible. Manufacturers are reminded that censorship permits are required in the case of catalogues despatched by parcel post or as freight to certain countries, details of which may be obtained from any Post Office. Applications for permits should be addressed to the Censor-in-Charge, Permit Branch, Postal and Telegraph Censorship Department, Aintree, Liverpool, 9.

The Department of Overseas Trade is the sponsoring authority in connection with visits of industrialists to France and other liberated territories, but the visits so far arranged have been for persons such as bankers, insurance officials, United Kingdom business interests with French subsidiaries, or persons otherwise qualified to assist in the rehabilitation of French economic life. If the Association, after discussions with the French Supply Mission, puts forward a case in support of some of its members visiting France in order to establish connections and foster an atmosphere of goodwill for British export trade, the D.O.T. will give the matter careful consideration.

The information given about trade with France applies similarly in the main to Belgium, Holland and Italy. By an announcement on February 1st, restrictions on private trade with Belgium are removed and theoretically normal trading conditions now exist. In practice, however, limitations of transport and supply will confine trade for some time to come to urgent needs, particulars of which can be ascertained from the Belgian Economic Mission in London.

Italy will require an immense amount of re-tooling as the Germans have either taken all the machinery and equipment away or destroyed it. But Italy is in an extremely impoverished condition and has no money to pay for imports.

The Association's Export Committee was to meet the French Purchasing Mission this week. It has also met the mission from the Turkish State Railways which is at present touring this country.

Symmetrical Components

Their Use in Connection with Transformers

By Dr. E. Holzer,
D.Tech.Sc. (Vienna)

A USEFUL method for tackling the problems of unbalanced load is to be found in the practical use of symmetrical components in the case of the three-phase transformer and its network. The questions to be answered concern current distribution, regulation and effect on the generator.

For brevity a single-phase load is assumed as a frequent practical case and the diagram for regulation is omitted. The case of the zero component of the current as an open circuit is excluded and one example only is chosen, *viz.* the star-interconnected-star connection (Fig. 1a and 1b). The load i between neutral and terminal a, at unity power factor (Fig. 1b) is split up in its three symmetrical components (Fig. 1c), each having the value $\frac{i}{3}$.

Regarding current distribution, the vectorial superposition of the components in the secondary (Fig. 1b) leads to the current i in phase a, and zero in phase b and c. The zero component being balanced by the two halves of the secondary, the plus and minus components remain for transference into the primary. This is vectorially done in Fig. 1a, where current J is in phase A and B, and zero current in phase C. There is a fixed relationship between J and i. From Fig. 1a it follows $J = \frac{i}{\sqrt{3}} \cdot \frac{e}{E}$.

For regulation again the three components are dealt with separately and superposed afterwards. The impedance of the three components can be but are not necessarily equal. In Fig. 1a and 1b the zero impedance is a fraction of that of the plus or minus component (the latter being equal) for the standard winding arrangement. There are, however, cases where all three impedances are bound to be equal, *e.g.*, for delta-star connection. As a comparison between these two connections, the regulation of Fig. 1a and 1b will be smaller in the loaded phase, provided both transformers have the same winding dimensions. However, the picture would not be complete unless the voltage drop in the supply line is also considered. From 1a the current J in phase B lags by 30 deg. and in phase A leads by 30 deg. with reference to the phase voltage of the supply source. For delta interconnected star the phase angles involved are zero in phase B, 60 deg. lagging in phase C and 60 deg. leading in phase A. However, comparing these two connections, the effect of the voltage drop in the supply line on the regulation is practically the same for unaltered performances.

Considering the effect on the generator, the line current J is split up into its symmetrical components (Fig. 1d, with reference to the voltage source). There is a plus and minus component only, each having the value $\frac{J}{\sqrt{3}}$. The minus component is decisive in its effect on the synchronous-generator causing excessive losses. Thus, for a comparison, it is necessary to check whether the minus components are equal or not. For instance, for star or delta interconnected star and for delta-star connections they are of equal value provided the load and voltage ratios are the same. So are the copper losses in the supply line. It is advisable to deal with each transformer connection individually.

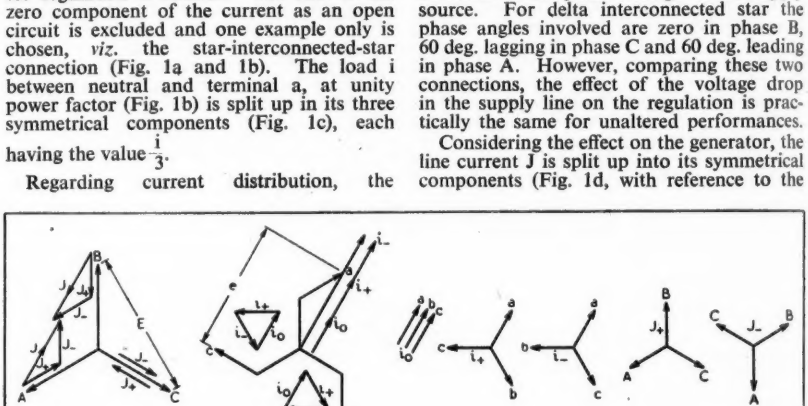


Fig. 1.—(a) Primary; (b) secondary; (c) symmetrical components of the load i; (d) symmetrical components of the supply currents J

Power Plant Shortage

In last week's leading article on this subject reference was made to the decision of the Ministry of Production with regard to the manufacture of generating plant. By a slip of the pen a sub-title was made to read "Ministry of Supply Decides."

COMMERCE and INDUSTRY

Bill to Prolong Fuel Ministry. Income Tax Allowances.

Fuel and Power Ministry

LAST week Major Lloyd George presented the Ministry of Fuel and Power Bill, the purpose of which is "to continue the present Ministry of Fuel and Power into peacetime and to give the Minister of Fuel and Power the necessary powers for the exercise of his functions both during and after the war." The Bill provides that the functions transferred to the Minister by the Ministers of the Crown (Minister of Fuel and Power) Order, 1942, shall be functions of the Minister appointed under the Act; these are set out in the First Schedule of the Bill. They include the functions formerly exercised by the Board of Trade in relation to electricity undertakings and the supply of electricity including functions relating to the Electricity Commissioners.

The first section states that the Minister "shall be charged with the general duty of securing the effective and co-ordinated development of coal, petroleum and other minerals and sources of power in Great Britain . . . and of promoting economy and efficiency in the supply, distribution, use and consumption of fuel and power. . . ."

Industrial Tax Concessions

As was foreshadowed in the Budget speech last year, some relief from taxation is to be granted to industry and agriculture. The Income Tax Bill introduced by the Chancellor of the Exchequer stipulates that from an "appointed day" expenditure on new buildings, plant and machinery incurred since April 1st last year shall qualify for relief from income tax. The initial allowance in respect of buildings is to be 10 per cent. with an annual allowance of 2 per cent. thereafter to write off the balance of the cost. Plant and machinery will be given an initial relief of 20 per cent. of the cost and the annual allowances are to be increased. This provision is to be applied to second-hand machinery which is newly installed by a concern.

After the appointed day an annual allowance is to be made for capital expenditure on the purchase of patent rights spread over seventeen years or less if the life of the patent is shorter. As regards research expenditure the relief granted by the 1944 Finance Act is to be extended to amounts allocated to this purpose since April 6th, 1944, and there is also to be an allowance in respect of capital expenditure incurred since January 1st, 1937, on buildings, plant and machinery for research purposes.

Future of Hire-Purchase

Addressing members of the Hire Purchase Trade Association at their annual meeting on February 13th, the chairman (Mr. R. B. Hurton) mentioned the assistance which the Association had afforded the Government in connection with price control. Dealing with the future of hire-purchase business he stressed its desirability, and even necessity, in securing equitable distribution of goods and spoke against unscrupulous traders who, to cover the granting of indiscriminate credit, charged excessive rates. Operated efficiently the costs of handling business could be reduced to the benefit of customers, and to themselves as well.

Mr. Hurton advocated extended terms where these were justifiable and an insistence upon at least 12½ per cent. initial payment. With regard to radio sets he thought that members would have to bring their hire-purchase terms down to the renting level if they wanted to effect sales.

A paragraph in the annual report says that reorganisation proposals held in abeyance during the war have been revived and it is hoped that by the time the European war ends definite proposals will be placed before members.

E.D.A. Annual Luncheon

The annual luncheon of the British Electrical Development Association is to be held at the Connaught Rooms, London, W.C.2, on March 16th (12.15 for 12.45) when the principal guest will be Sir Stafford Cripps, K.C., Minister of Aircraft Production.

Export of Lighting Fittings

Among items included in the Export of Goods (Control) (No. 2) Order, 1945, are electrical fittings, wholly or mainly of metal, of a kind used for street or interior lighting. The Order (S.R. & O. 1945 No. 150, price 1d.), which came into force on February 12th, removes these from the Schedule to the 1943 Order and consequently licences are now only required when they are exported to those destinations in the case of which all goods are controlled.

"Electrical Review" Index

Readers who require copies of the index to Vol. CXXXV (July-December, 1944) for binding purposes may now obtain them from the Publisher, *Electrical Review*, Dorset House, Stamford Street, London, S.E.1.

Cable-Making J.I.C.'s Silver Jubilee

The cable-making industry has the distinction of having been one of the first to establish regular joint consultation machinery on a voluntary basis, and this year the Joint Industrial Council for the industry reaches the twenty-fifth anniversary of its formation. The Council, which was formed at a conference held at the Ministry of Labour on July 10th, 1919, held its first meeting on September 4th of that year, being attended by representatives of the Cable Makers' Association, the trade unions and senior representatives of the Ministry. In September, 1921, the Independent Cable Makers' Association joined the Council and has participated in its activities ever since.

The present member unions are the United Rubber Workers of Great Britain, the Electrical Trades Union, the National Union of General and Municipal Workers and the Transport and General Workers' Union.

At the first meeting Mr. Llewelyn B. Atkinson (employers' side) was unanimously elected chairman and although the constitution of the Council

provides for the appointment of a chairman for one year the trade unions each year proposed his re-election and he remained in office until his death in 1939. On a proposal from the employers' side Alderman E. Porter (National Union of General and Municipal Workers) was then elected chairman of the Council, which position he still holds.

The advent of the present war raised many problems, and it is gratifying that through the machinery set up at the close of the last war mutually satisfactory agreements were negotiated on such matters as the temporary employment of women, modified procedure for the avoidance of disputes, part-time workers and revision of the classification of specialised occupations.

Contract Price Adjustment Formulæ

The latest figures for the B.E.A.M.A. contract price adjustment formulæ, are—(*a*) " Rates of Pay ": the rate of pay for adult male labour at February 17th shall be deemed to be 90s. 6d. (*b*) " Costs of Material ": the index figure for intermediate products last published by the Board of Trade on February 17th is 176·9 (against 176·2) and is the figure for the month of January.

Swansea Apprenticeship Scheme

Recommendations made by the borough electrical engineer of Swansea (Mr. H. E. Blackiston) on future arrangements for apprenticeships were recently approved by the Electricity Committee. Mr. Blackiston suggested that a scheme could be adopted whereby promising apprentices could be permitted after three years' service to attend a course at the University College or the Technical College to obtain Higher National Certificates.

The " Blue Book "

The 1945 " Blue Book " (Electrical and Engineering Trades Directory), just published by Ernest Benn, Ltd., Bouverie House, Fleet Street, London, E.C.4, price 30s., is the sixty-third edition of this useful guide to the organisations of the electrical and engineering industries. Apart from revision and correction no change has been made on this occasion and the number of pages (719) is much the same as in last year's edition.

Electricity Supply Personnel

Statistics prepared by the Electricity Commissioners show that although between the end of 1939 and the end of 1943 there was an increase of 40 per cent. in kWh generated, the total number of people employed in the electricity supply industry at January 1st, 1944, was only 74·5 per cent. of the March 31st, 1939, figure. The decrease was largely due to the smaller number of employees on the transmission and distribution side (57·3 per cent. of the 1939 total). Staffs employed on operational, maintenance and constructional duties in generating stations actually represented 124·8 per cent. of the 1939 figure; the percentage on the administrative, financial, technical, clerical and head office staffs was 81·5.

A notable feature is the increase in the number of female employees from 7,111 in 1939 to 14,182 at the beginning of 1944, out of total personnel of 120,731 and 89,944. This was not mainly due to an influx o women into the clerical branch, as might have been expected. In this branch the number rose from 6,296 to 9,747, but on the operational, etc., side the increase was from 140 to 1,586 and in transmission and distribution from 675 to 2,849.

A total of 37,158 men and women were released to the Forces or other industries during the four years.

Mercury Battery

The development of a dry cell in which fluid mercury is a prime component is reported by *Reuter's Trade Service*. It is claimed to develop as much power and, in continuous use, to last about five times as long as an ordinary flash-light battery of comparable size.

The new mercury cell has a steel case as the positive pole (instead of a zinc case as the negative) and a zinc pellet placed at the top of the case, from which it is separated by an insulator, serves as the negative pole. The inventor's name is given as Samuel Ruben, an electro-chemist of New Rochelle, N.Y. Manufacturing rights are held by the P.R. Mallory Co. of Indianapolis.

Northampton Electrical Association

At the monthly meeting of the Northampton and District Electrical Association on February 14th diagrammatic films were shown illustrating how the telephone and dial worked. A film lent by Black & Decker, Ltd., showed the manufacture of portable electric tools and their uses in all branches of industry, while the uses and adaptability of the cathode-ray oscillograph were demonstrated by a further film. The main feature of the programme was the film " The Valley of the Tennessee " lent by the American Office of War Information. Over fifty members were present and twenty applications for membership were accepted before the general meeting.

International Radio Services

Mr. Francis Colt de Wolf, chief of the Telecommunications Division, U.S. Department of State, speaking before the Institute of Radio Engineers, said that the recommendations of the Federal Communications Commission for post-war frequency allocation for radio services operating between 25 and 35,000 Mc/s had opened up new vistas for radio. The next international conference would thus be confronted with the tremendous problem of devising an adequate control of radio so that it would be of maximum benefit to all the users.

While unable to go into details of their post-war plans for telecommunications, he said they had in mind a modernisation of existing international bodies. They had plans for the saving of radio frequencies and were considering means to assure radio services to certain points for 24 hours a day without interference from the magnetic pole. In one case they had already accomplished this in a service between New York and Moscow through a relay operated by an American radio company station at Algiers. Their Government engineers were now studying the possibility of the so-called equatorial belt system and at the same time were busy on a plan which, it was thought, would be even better than routing radio waves

along the equator. Some time in the near future they anticipated holding a conference with the representatives of the British Commonwealth with a view to making the communications between the English-speaking peoples more efficient and economical.—*Reuter's Trade Service.*

J. & P. Developments

Among products developed in 1944 by Johnson & Phillips, Ltd., Charlton, London, S.E.7, is switchgear of an entirely new design, being of the air-insulated metalclad type for vertical isolation and incorporating a cross-jet box breaker. It is suitable for small power stations, but should be most useful in sub-stations of limited floor area, for the width of the gear is only 1 ft. 10½ in. It is made for voltages up to and including 11 kV and for breaking capacities up to and including 250 MVA. A considerable number of these switches have already been sent to South Africa.

Equipment for the quick yet accurate testing of voltage transformers has been patented. It can form a convenient adjunct to a supply authority's meter testing bench where it would derive its energy from the variable voltage three-phase input already available there. The equipment consists of a special testing transformer which, in effect, combines the functions of a step-up transformer and eliminates the necessity for any phase-splitting circuits. It can be made to have errors that can be proved to be negligible, so making the system equivalent to one that is absolute. Changing from one phase to another is accomplished by means of a pair of multiple switches, there being no need to switch off or touch high-voltage connections. Balancing is effected by two slide wires or decade potentiometers.

Trade Publications

Welwyn Electrical Laboratories, Ltd., 70, Bridge Road East, Welwyn Garden City, Herts.—Illustrated two-colour catalogue giving technical details and dimensions of vitreous enamelled and lacquered wire-wound resistors, as well as of stable carbon and porcelain varieties.

J. G. Statter & Co., Ltd., 82, Victoria Street, London, S.W.1.—Illustrated leaflet (No. 400) technically descriptive of time-limit fuses for delaying the action of trip coils, operated by current transformers, in association with oil-immersed circuit-breakers.

British Insulated Cables, Ltd., Prescot, Lancs.—Technical leaflet (NSC.12) containing essential data on radio-frequency cables of various types for different purposes.

Applications for copies of these publications should be made on business letter-headings.

Electrical Manufacture in America

During 1944 production figures for the United States electrical manufacturing industry showed an increase of 5 per cent. over the 1943 index, the previous peak, according to Mr. W. J. Donald, of the National Electrical Manufacturers' Association. Mr. Donald says that about $9,000 million worth of merchandise was produced by electrical manufacturers last year, the biggest increase recorded being in signalling and communications equipment. Other increases were noted in illuminating equipment, insulating materials and X-ray and therapeutic apparatus. Output of industrial apparatus, wire and cable, transmission and distribution equipment continued steady. There was a 50 per cent. decline in sales of major appliances and this offset the slight gains in the sales of small types. Sales in 1944 were limited to meet the requirements of the Forces and to keep in business electrical appliance dealers had to manufacture or sell such items as paint, furniture, glassware, books and used cars.

Applications from 57 manufacturers to make small electrical appliances have been approved by the War Production Board for 1945. This is announced in a statement from the W.P.B. which also says that prospects for the re-conversion of the manufacturers of heavy electrical goods are remote.—*Reuter's Trade Service.*

Fatality

Bowl Fire in Bathroom.—While having a bath in her home, Mrs. Annie Margaret Goodwin (38), of Harlesden, received a fatal electric shock. At the inquest at Kilburn it was stated that her left hand was over the edge of the bath, and an electric bowl fire stood on the floor about 18 ins. away. The flex was plugged into the lampholder in the ceiling and hung straight down. Dr. Teare said that there was extensive burning round and between the thumb and first finger and there were burns on the forearm It appeared as though the woman was gripping the flex when she received the shock. Mr. J. H. Greenwood, mains superintendent, Willesden Borough Council, stated a three-core flex was fitted to the fire and two of the wires were placed in the lighting plug. The earth wire was exposed and not in use. He also found that one of the wires from the supply was defective and that caused the metal frame of the electric fire to become "alive." A verdict of "Accidental death" was recorded, the coroner agreeing with Mr. Greenwood that such fires should not be used in bathrooms.

Trade Announcement

Barries Electrical Agencies, Ltd., King Street, Brighton, have been appointed sole selling agents for "Stanelec" switchgear (Stanton & Co.) except in the Midlands.

Change of Name

The name of the Keighley Electrical Engineering Co., Ltd., has been changed to Keighley Lifts, Ltd.

TRADE MARKS

RECENT applications for trade marks include the following, objections against which may be entered within a month from February 14th :—

Monogram embodying company's initials. No. 631,617, Class 9. Electrical apparatus, not included in other classes, for domestic purposes. —Cowper, Penfold & Co., 68, Coleman Street, London, E.C.2.

FERODO.—No. 629,860, Class 17. Electric insulators, electric and heat insulating material, etc., all made wholly or principally of asbestos.—Ferodo, Ltd., Sovereign Mills, Hayfield Road, Chapel-en-le-Frith, Derbyshire.

Views on the News

Reflections on Current Topics

THE title given to the exhibition now running at the Royal Institute of British Architects, Portland Place, W.1, is rather misleading. It is described as an exhibition of French prefabricated houses, but in fact it comprises a series of drawings and photographs of studies for houses of steel-frame construction with some suggestions for metal "walls." The most impressive (and appalling section) is a collection of photographs of the devastation wrought in some of the age-old French cities which nothing can replace.

I could find only one drawing with any electrical significance. It shows a kitchen in one of the new dwellings. In contrast with our own insistence on "flushness," there are two sizeable projections from the general elevation of the cupboards, etc. One of these is formed by the cooker which appears to have twin ovens, three circular hotplates and a grill-boiler plate. The other projection houses what may be a refrigerator. Throughout the exhibition there is insistence on methods of construction rather than on types of houses.

* * *

Following upon the decision of the Edinburgh Town Council (mentioned last week) to equip its temporary houses with gas appliances I am not surprised to hear of protests from the women. A resolution has been passed by a meeting of the Edinburgh and South-East of Scotland Women's Community Service Clubs regretting the Council's decision, believing this to be a retrograde step, and recording a preference for all-electric services in temporary houses "as an experiment." But I cannot imagine why this last qualification was considered necessary when all-electric houses are now well-tried, commonplace, everyday sort of dwellings.

* * *

Latest decisions on the equipment of temporary houses which have come to my notice are those of Torquay (which is to have half and half); Swindon (where the tenants are to choose for themselves, which does not seem to square with the memorandum on "Temporary Accommodation"); Chesterfield (all-electric); and Bromley (34 gas and 343 electric).

* * *

The jest about "plain vans" in connection with hire-purchase is an old one but it was given a new twist last week by the chairman of the Hire Purchase Trade Association (Mr. R. Burton) at that body's annual meeting. He was dealing with price control Orders and with the confusion which arose from their interpretation and said that they had all heard of plain vans but how they wished for plain language in these Orders, although they realised the difficulties in drafting. It must be said in justice to Government Departments that during the past year or two many S.R. & O.'s have had appended to them simple statements of their meaning and effect but this is not always possible.

* * *

The North of Scotland Hydro-Electric Board is not going to get away with its No. 2 Constructional Scheme without another outburst of protest from Highlanders, who fear that amenities are threatened. Remembering the early enthusiasm for the development of Scottish water power these objections must appear to the Board to be ungrateful. It seems to me that while they approve the principle of these schemes many Scots jib at concrete proposals.

The Loch Sloy scheme, which also had to stand criticism, has been approved by the Secretary of State for Scotland. Mr. John Cameron, who conducted the inquiry into the scheme, evidently considered that the objectors were entitled to their say for he apportioned the costs between them and the Board.

* * *

During her month in Sweden and Finland on behalf of the British Council, Miss Caroline Haslett tells me she found everywhere intense interest in electrical developments in Great Britain during the war and a consequent strong desire to receive copies of our technical papers. Yet how much more fully could the requisite information be given to these and other countries but for space limitations imposed by the present meagre paper ration. While Sweden is, of course, progressive electrically, comparisons in the domestic sphere are by no means unfavourable to Britain. A most popular publication over there just now is the I.E.E. Post-War Installations Report, the production of which in the middle of tribulation is regarded as a mark of the virility of our electrical industry and its determination to survive.

* * *

Again I have to go to America, *via* the *Daily Express*, for this week's "high spot." In a Hollywood divorce settlement, our contemporary says, a man was awarded custody of the refrigerator and his wife was given the washing machine. There was no contest over the two children, who went with the washing machine.

British Electrical Exports

Large Shipments of Machinery to Russia

DISREGARDING the effect of increased prices, exports of electrical goods and machinery from this country last year were substantially greater than before the war. This surprising expansion was the result chiefly of special consignments of machinery to Russia.

The latest Board of Trade return (Stationery Office, 1s.) shows that, while exports of all kinds last year amounted in value to £258·1 million against £470·8 million in 1938, shipments of electrical equipment had a total value of £24,662,758 as compared with £21,324,717. On the general position it is stated that consignments to every South American country were drastically reduced. Towards the end of the year exports of essential supplies started to the liberated countries of Europe.

The exports of electrical goods and machinery are shown individually in Table I and the destinations in Table II, the increase in supplies to Russia being reflected in the higher figures given under "foreign countries." In the cable group there were considerable fluctuations in the consignments to different countries as will be seen in the following analysis (1943 values in brackets):—

Rubber insulated wires and cables:

TABLE I.—ELECTRICAL EXPORTS BY VALUE

Description	1943	1944
	£	£
Telegraph and telephone cables (submarine)	284,983	395,827
Ditto (not submarine)	1,200,138	920,230
Other rubber-insulated wires and cables	894,009	1,382,334
Wires and cables, insulation other than rubber	1,299,016	1,267,442
Radio receivers, not radiograms (excluding valves)	114,010	95,399
Radio transmitters (excluding valves)	1,062,629	839,199
Radio valves	678,814	1,255,322
Other radio parts and accessories	374,185	764,815
Telegraph and telephone apparatus other than radio	1,543,658	1,516,528
Electric lamps	556,478	564,998
Other lighting apparatus	343,933	398,144
Primary batteries	112,495	142,932
Accumulators, portable	263,237	336,713
Ditto, stationary	124,633	119,221
Ditto, parts and accessories	137,401	141,611
Cooking and heating apparatus, including industrial	82,555	107,283
House service meters	100,047	85,119
Other electrical instruments	309,320	466,845
Insulating material not elsewhere specified	176,212	241,757
Unenumerated electrical goods	1,433,617	1,595,573
Electric generators up to 200 kW	341,347	790,169
Ditto, over 200 kW	1,241,027	1,736,211
Electric motors	932,688	1,773,697
Converting machinery	41,793	19,076
Transformers	1,026,593	1,375,029
Rectifiers for power-house use	36,018	54,722
Starting and controlling gear for motors	313,522	371,195
Switchgear	1,364,615	1,453,500
Other electrical machinery	1,279,771	4,451,867
Total	£17,668,744	£24,662,758

TABLE II.—DESTINATIONS

Country	Goods and Apparatus 1943	Goods and Apparatus 1944	Generators 1943	Generators 1944	Motors 1943	Motors 1944
	£	£	£	£	£	£
Eire	188,439	133,395	*	*	*	*
Palestine	84,004	77,369	*	*	*	*
British West Africa	223,169	173,651	*	*	*	*
Union of South Africa	2,439,099	1,427,576	219,816	55,634	229,741	212,510
British India	954,311	1,628,128	210,404	279,778	275,316	370,358
Ceylon	84,799	152,976	*	*	*	*
Australia	2,275,019	2,821,404	269,677	186,743	52,966	55,339
New Zealand	1,221,538	1,851,755	*	*	108,417	132,424
Canada	441,205	494,189	86,243	84,645	5,619	13,307
Southern Rhodesia	690,291	137,693	*	*	*	*
British East Africa		127,170	*	*	*	*
Other British Countries		362,847	195,354	221,148	79,899	118,571
Egypt	200,163	213,903	*	*	*	*
Brazil	56,520	79,746	*	*	*	*
Argentina	56,388	40,537	*	*	*	*
Iran	2,176,425	125,758	*	*	*	*
United States		183,422	*	*	*	*
Other Foreign Countries		2,605,773	600,880	1,698,432	180,730	871,188
Total	£11,091,370	£12,637,292	£1,582,374	£2,526,380	£932,688	£1,773,697

* Not separately classified.

South Africa, £24,378 (£211,550); British India, £338,672 (£112,881); Australia, £384,134 (£364,021); New Zealand, £49,715 (£46,224); other British countries, £86,602 (£86,316); foreign countries, £498,833 (£73,017).

Wires and cables, insulation other than rubber: South Africa, £97,205 (£158,223); British India, £362,457 (£197,399); Australia, £343,642 (£277,249); other British countries, £297,504 (£327,580); foreign countries, £166,634 (£338,565).

Exports of telegraph and telephone apparatus other than radio were also maintained through increased shipments to foreign countries, as the following figures show:—South Africa, £170,298 (£302,553); Australia, £338,527 (£481,689); other British countries, £395,210 (£374,063); Argentina, £6,009 (£14,563); other foreign countries, £606,484 (£370,790).

The overall index of average values last year was 178 against 171 in the previous year, taking 1938 as 100. The effect of this is generally shown roughly by comparing the figures given for volume with those for value. In the case of "other electrical machinery" (transformers, switchgear, etc.), however, while the weight rose from 18,371 to 40,086 tons, the value increase from £4,062,312 to £7,725,389 was not proportionally so great. Exports of generating plant, by volume, increased from 5,288 to 9,692 tons and motors from 4,816 to 8,020 tons.

In the goods and apparatus section, exports of radio sets other than radiograms fell in number from 10,973 to 5,388, while valves shipped overseas increased from 974,311 to 1,902,488. For other goods the numbers exported were as follows (1943 figures in brackets): Lamps, 12,776,000 (13,100,000); portable accumulators, 233,052 (190,710); stationary accumulators, 11,873 (19,134); meters, 37,652 (56,672).

Exports of steam and electric winding machinery for mines, which are not included in the tables, amounted in value to £591,738 against £585,432 in 1943 and vacuum cleaners and parts to £4,091 (£2,433).

Forthcoming Events

Saturday, February 24th.—*Bradford.*—Great Northern Victoria Hotel, 2.30 p.m. I.E.E. North Midland Students' Section. Discussion on "Frequency Modulation," to be opened by Dr. J. H. Mole.

Monday, February 26th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Informal discussion on "Location of Industry," to be opened by D. B. Williamson.

Birmingham. — James Watt Institute, 6 p.m. I.E.E. South Midland Centre. "Elementary Description of some Molecular Concepts of the Structure of Dielectrics," by Dr. E. B. Moullin, M.A.

Newcastle-on-Tyne.—Neville Hall, 6.15 p.m. I.E.E. North-Eastern Centre. "Standardisation and Design of Turbo-Alternators," by G. A. Juhlin.

Bristol.—Small Physics Lecture Theatre, Bristol University, 5 p.m. I.E.E. Western Centre Installations Group. Inaugural meeting. "Future of Domestic Wiring Installations," by Forbes Jackson and W. J. H. Wood (Part I) and G. Smith and E. Jacobi (Part II).

Tuesday, February 27th. — *London.* — At Institution of Electrical Engineers, 6 p.m. Television Society. "Vertical *v.* Horizontal Polarisation," by Dr. H. P. Williams.

London.—At Institution of Mechanical Engineers, 5.30 p.m. Illuminating Engineering Society and R.I.B.A. "Relationship between Interior Design in Building and Artificial Illumination," by Dr. J. W. T. Walsh.

Cardiff.—South Wales Institute of Engineers, 5 p.m. Same as February 26th (Bristol).

Leeds.—Great Northern Hotel, Wellington Street, 6 p.m. I.E.E. North Midland Centre. "Standardisation and Design of AC Turbo-Type Generators," by G. A. Juhlin.

Newcastle-on-Tyne.—Neville Hall, 6.30 p.m. I.E.E. North-Eastern Students' Section. Students' Lecture: "Electrical Engineering Research," by H. W. H. Warren.

Wednesday, February 28th. — *London.* — Institution of Electrical Engineers, 5.30 p.m. Radio Section. "Multi-path Interference in Television Transmission," by D. I. Lawson, M.Sc.

London.—At Institution of Structural Engineers, 11, Upper Belgrave Street, S.W.1, 6 p.m. British Institution of Radio Engineers (London Section). "Dielectric Heating by the Radio-frequency Method," by L. Grinstead.

Birmingham.—James Watt Institute, 7 p.m. I.E.E. South Midland Students' Section. Address by F. W. Lawton, Centre chairman.

Birmingham. — University (Latin Theatre), Edmund Street, 6 p.m. British Institution of Radio Engineers (Midlands Section). "Magnetic Dust Cores," by E. R. Friedlander.

Edinburgh.—Heriot-Watt College, 6 p.m. I.E.E. Scottish Centre. "Remote Switching by Superimposed Currents," by J. L. Carr.

Thursday, March 1st. — *London.* — Institution of Electrical Engineers, 5.30 p.m. "Stray Losses in Synchronous Electrical Machinery," by P. Richardson.

Friday, March 2nd. — *Bath.* — Pump Room, 7.15 p.m. I.E.E. Bristol Students' Section. Talk on "Television," by D. J. Clatworthy.

Saturday, March 3rd. — *London.* — Lysbeth Hall, Soho Square, 6.30 to 10.30 p.m. I.E.E. London Students' dance (date altered from March 10th).

Leeds.—At Y.M.C.A. Albion Place, 4 p.m. Engineer Surveyors' Association. "Electricity as Applied to Mining," by B. Buckland.

Monday, March 5th. — *London.* — Institution of Electrical Engineers, 7 p.m. London Students' Section. "Mercury-Arc and Mercury-Vapour Rectifiers in Transmitters," by T. M. Ellison.

Scottish Water Power

Loch Sloy Scheme Approved. Rating Proposals Debated.

THE Loch Sloy hydro-electric scheme has been confirmed by the Secretary of State for Scotland in an Order the terms of which were published last week in a document containing full details and maps. A description of the events leading up to the recent inquiry, including the report by Mr. John Cameron, D.S.C., K.C., are published separately as a White Paper. The confirming Order and details of the finally approved scheme must lie before Parliament for forty days, and may be annulled by resolution of either House within that period. Work can begin at the end of forty days if the Order is not annulled.

Recommending that the scheme should go forward Mr. Cameron states that in future the Board should, before putting forward any new schemes, make quite certain that it has selected practicable sites. This follows criticisms of the Board's action in deciding, shortly before the date of the inquiry, to change the site of the Loch Lomond power station. The Board, states the report, established clearly the urgent public need for the electricity which would be made available nationally from the Loch Sloy project. No serious technical objections were made to the scheme, and those based on grounds of cost and amenity failed.

A main objection related to the competing schemes of the Dumbarton County Council for the use of Loch Sloy for private purposes. Evidence submitted by the Board indicated that there were within the county adequate alternative resources for a daily supply of 40,000,000 gallons. Mr. Cameron says that he was " unfavourably impressed " by the lack of information in detail about the large-scale housing programme for which the county claimed that the waters of Loch Sloy were required.

None of the objections could be categorised as " frivolous "; indeed, substantial issues of urgent public importance were raised by most of the objectors. In the circumstances Mr. Cameron recommends that there should be no Order by the Secretary of State in relation to expenses of the parties, but that the expenses of the Secretary of State in relation to the inquiry should be shared in equal proportions by the North of Scotland Board and the objectors.

Hydro-Electric Rating

Mr. Johnston, Secretary of State for Scotland, in moving the Second Reading of the Hydro-Electric Undertaking (Valuation for Rating) (Scotland) Bill in the House of Commons last week, said that its genesis was to be found in the report of the Departmental Committee on Hydro-Electric Development in Scotland which stated that local taxation imposed on hydro-electric public supply undertakings much heavier burdens than on equivalent steam power undertakings. A steam coal undertaking was allowed to deduct very large sums expended on fuel, but a hydro-electric undertaking had no fuel costs to deduct and was prohibited from deducting any part of its annual charges on civil engineering works which were the counterpart of fuel costs. The Committee had pointed out that a power station of a certain size would pay £35,000 in rates if steam operated, but if it were operated by water power it would pay about £106,000.

Under the proposals in this Bill, the citizens would quickly gain in cheaper electricity supplies. They would gain because of the new improvements and the Hydro-Electric Board. Clause 5 of the Bill dealt with the method by which undertakers other than the Hydro-Electric Board must return whatever relief they got either by development of their system of distribution or by reduced prices to their consumers. The Board must either develop its distribution system to the extent of the relief which it got, or it must cheapen the cost to its consumers. Neither the Hydro-Electric Board nor the Grampian Company was treated in the slightest way differently in so far as new works were concerned. The Board got no relief until it put down its stations and so far as the Grampian Co., which was already paying rates under the existing system, was concerned, it would only get relief after there were new works created, either by the Hydro-Electric Board or the Grampian Co. in the area to the equivalent amount of the reduction, and even then whatever relief they got must be either passed on to the consumer or used to develop electricity in the area.

Members' Views

Sir Arnold Gridley said there was a good case for the Bill, but all undertakings should be treated the same.

Mr. M. Macmillan said the effect of the Bill ultimately would be to subsidise the undertakings concerned at the ratepayers' expense.

Sir Herbert Williams, moving the rejection of the Bill, said that the Hydro-Electric Board was going to secure these concessions for all its works whereas the Grampian and Galloway Companies would only get them in connection with new works. He described it as discrimination in favour of one method of generating electricity against other methods.

Mr. Craik Henderson said the Bill appeared on the face of it to discriminate between the latest hydro-electric undertaking and the old companies. He hoped that the Bill would develop the hydro-electric schemes in Scotland but they did not want to see this done by discrimination between the child of the Government and the ordinary industrial hydro-electric scheme. Sir Arnold Gridley suggested that improvements could be made to the Bill which would make it all the more acceptable, and Mr. Macmillan said that if there was a subsidy it should be a national subsidy and not by way of relief at the expense of local authorities.

After further debate Mr. J. S. C. Reid, the Lord Advocate, said that practically all the criticisms were based on misunderstanding. It was certainly not the intention of the Government that there should be discrimination and they would welcome further consultations.

The motion for the rejection was withdrawn and the Bill read a second time.

PARLIAMENTARY NEWS

By our Special Reporter

Reorganisation Proposals

IN the House of Commons on February 13th Major Lloyd George told Mr. Oldfield that the report of the Association of Municipal Corporations on the electricity supply industry, together with other proposals for the reconstruction of the industry, was being considered by the Government, but he was unable to say when he would be in a position to make a statement on the Government's policy in this matter.

Factory Supplies

Mr. Wootton-Davies asked the Minister of Fuel and Power if he was aware that factories which could produce electricity at a low cost were discouraged from so doing by the high stand-by charges of electricity undertakings; and what steps he was taking to encourage production of electricity by factories.

Major Lloyd George said he had no information which indicated that in general electricity undertakings were quoting unreasonable terms for stand-by supplies of electricity. If, however, he was given particulars of any case he would ask the Electricity Commissioners to inquire into it. As regards the second part of the question the installation of a private generating plant in a factory was a complicated technical question which had to be settled on the merits of each case. During the war the shortage of electrical plant would in any case have precluded large-scale additional generation by factories. The whole subject was at present being studied by his Ministry.

Stand-By Plants

Mr. Chorlton asked the Minister of Fuel and Power whether, during the period of unusually high electricity demand, oil-engine generating plants kept for service in case of a breakdown were actively employed to assist the main stations and, if not, why not, as they must have had stores of oil fuel in reserve.

Major Lloyd George said that the principal purpose of the oil engine plants referred to was to provide a stand-by supply in case of breakdown of the public supply of electricity. He was advised that in some cases they could only meet partially the requirements of the consumer and there were serious technical difficulties in working these plants in conjunction with the public supply system. In view, however, of the unprecedented demand this winter, he had ordered a thorough investigation into the possibility of using these plants on future occasions when it might become necessary to shed load.

Heating Appliances

Mr. Rostron Duckworth asked the Minister of Fuel and Power what progress was being made to ensure that in the interests of the efficient use of fuel all heating appliances sold for use in domestic premises in this country should be specified to fulfil adequate performance tests.

Major Lloyd George said that performance standards for most domestic fuel burning appliances, or methods of assessing their performance, had already been laid down or would be completed shortly by the British Standards Institution. The attention of local authorities had been drawn to these specifications by the Minister of Health, and it was hoped that appliances installed in domestic premises after the war would comply with the appropriate standards.

C.E.B.'s Plant Programme

Answering Mr. Higgs, Major Lloyd George said that provision of the necessary labour and materials for carrying out the programme of generating plant promoted by the Central Electricity Board was receiving his active consideration. He could not say when he would be able to make a statement on the subject.

Wireless in Trains

On February 14th Sir Dymoke White asked the Parliamentary Secretary to the Ministry of War Transport if he would consult with the railway companies on the possibility of their engines being fitted with radio-telephony sets, with correspondingly suitable sets at control points, with a view to relieving the anxiety of engine drivers proceeding blind, and thus slowly, in bad weather, and incidentally doing away with railway delays.

Mr. Noel Baker said he was advised that there was as yet no radio apparatus which would afford a satisfactory remedy for the failure to observe signals. It was not at present practicable to carry out the experiments required to perfect the present apparatus. He hoped that it would be possible to undertake this work after the war.

Rural Supplies

On February 15th Mr. De Chair asked the Minister of Health whether the specific recommendation of the Scott Report that all new cottages in rural districts should be wired for electricity during their construction, whether or not the supply was at present available, was being complied with.

Mr. Willink said that some of the wartime agricultural cottages were wired in advance for electricity where it was reasonably likely that a supply would be available in the not too distant future. It was the Government's intention that new Council cottages in rural areas should be built so far as possible in or near existing villages where public services were more readily available.

Replying to Sir Henry Morris-Jones Mr. R. S. Hudson said that the extended use of electricity on farm premises generally was under review in connection with post-war agricultural policy, and favourable consideration was given, notwithstanding present restrictions, to the authorisation of electricity supplies to farms where a substantial increase in food production or saving in manpower was likely to result. He was not in a position to give any indication of the date when these extended supplies were likely to become operative.

Permanent Magnets

Economic Utilisation of Modern Types

MODERN anisotropic alloys have greatly increased the scope of permanent magnets intended for incorporation in electrical apparatus. The shape of their demagnetisation curve, which differs from that of the older materials, has brought into prominence the lack of knowledge about the design of permanent magnets, apart from the simplest cases.

With a view to the economic utilisation of such magnets MR. D. J. DESMOND (Joseph Lucas, Ltd.) has tackled their design in an unfamiliar manner, in terms of the constants of the iron circuit. In calculating that part of the magnetic energy which can be usefully employed, a new method has been introduced (due to Dr. A. Edwards, of James Neill & Co., Ltd., Sheffield) of making use of the unit permeance of a circuit, or the permeance "as seen from each centimetre cube" of the magnet. The method is explained in a paper, read before the Measurements Section of the Institution of Electrical Engineers last Friday, which contains an account of an investigation into the poor performance of a small generator fitted with anisotropic magnets whose dimensions were determined by considerations of interchangeability with isotropic magnets operating at a BH_{max} value according with existing practice.

It was found that a considerably greater quantity of the newer material was required to maintain the same flux as the older type produced, meaning that all the additional energy of the anisotropic alloy cannot be usefully employed because its larger curve factor reduces recovery when the demagnetising force is removed.

It is shown that the BH_{max} value is not the criterion of usefulness of a magnet, except in the simplest case, nor is it necessary for the magnet to work at the maximum point on its BH curve. Thus other factors have an important influence on magnet design, but the mathematical analysis of the subject is very complicated. However, by making a few simplifying assumptions, a first approximation has been arrived at without undue difficulty. The assumptions are discussed by the author as they arise in his explanatory paper, which refers all characteristics back to the fundamental demagnetisation curve; the new method is, to make the magnet work at a critical point which depends upon the leakage coefficient as well as the purpose for which the magnet is required.

The most valuable feature of a permanent magnet is its power of recovery after being subjected to a demagnetising force, which depends on the reversible permeability, or the slope of the recoil line. Thus, a small curve is to be preferred, so long as it remains associated with the same BH_{max} value. Increase of the latter by mere enlargement of the former does not fully materialise as augmented energy. The author realises that he has submitted only a first approximation and that a considerable amount of further work is still required to provide an accurate insight to the actual working of a permanent magnet.

Incidentally, he has attempted to introduce a number of fresh symbols and definitions, but the units in which some of the quantities are measured will need to be standardised by general agreement. For example, he would welcome something less clumsy than "gauss per oersted" or c.g.s. units, for reversible permeability and unit permeance; similarly, "gilbert per maxwell" is scarcely appropriate as the unit of reluctance while "megagauss—oersted" is no better for magnetic energy.

Discussion

In opening the discussion MR. C. E. WEBB (National Physical Laborartory) said this was one of the most valuable papers since the classical paper by Evershed, and it covered a wider field. Mr. Desmond used μ_r to represent reversible permeability, the slope of a recoil line. The speaker thought a more simple and expressive term would be "recoil permeability," because the permeability represented by μ_r was no more reversible than any other and, moreover, the term had already been used for another quantity. The author rightly suggested that one of the most important characteristics was the recoil permeability and that it depended on the curve factor. But the curve factor was extraordinarily constant in the case of certain magnet alloys, such as the martensitic alloys or the "Alnico" type, so he would have said that the most important factor in determining the value of the recoil permeability was the ratio of remanence to coercive force. He thought that actual measurements of recoil permeability for specifying the quality of a particular sample were unnecessary and that remanence and coercive force would, within each group, give a very good pointer to the value of the recoil permeability.

PROFESSOR L. G. A. SIMS (Royal Naval College, Greenwich) asked whether the author's assumption that every part of the magnet worked at the same point on its BH characteristic was borne out in practice.

MR. A. J. TYRRELL (Mullard Valve Co.)

said that the author's calculations appeared to have been based on the least efficient anisotropic material (" Alcomax ") whereas " Ticonal " and " Alnico V," as commercially manufactured, had a BH_{max} of 4½ to 5 millions and a reversible or recoil permeability in the region of 4, which the author himself in his conclusions stated were more desirable characteristics. The calculations and charts should have been based on the performance of the best materials available. Although Mr. Desmond stated that the composition and heat treatment of these materials had not been published, the specification of " Ticonal " was given in 1938 and the composition and heat treatment of " Alnico V " had been published in American technical journals. It was usually found under practical conditions that the leakage flux represented the major part of the total flux produced by a permanent magnet. Therefore he submitted that the paper did not contribute so much as could be wished to the practical design of apparatus using permanent magnets.

Importance of Constancy

MR. F. C. KNOWLES (Evershed & Vignoles) said it was a pity that this excellent paper fell down just where the designer needed most help in computing the leakage flux which, according to the diagrams, one could assume to be of the order of 40 per cent. of the total flux. There were so many modern materials coming along that the instrument manufacturer, in order to take advantage of them, must really design afresh. Constancy was very important. With the older materials, if the armature was removed and put back after stabilisation, the field was reduced; but with the newer magnetic materials there was a gradual tendency for the magnetic field to increase. That was a useful factor in some degree, but its existence must be realised. As regarded the stabilisation of the magnetic field by removal of the armature, it was the general practice of his firm to short-circuit the generator to ensure stability. It was not yet known how the length, breadth and shape of the modern magnet affected the stability. The paper dealt with what might be called the block form of magnet, but many magnets were cast and that would have to be taken account of in design. There was also the new sintered type of permanent magnet which would be used for very small instruments.

DR. H. G. TAYLOR (Phillips Industrial) expressed the view that the paper was unduly biased towards generators and magnetos. Others mainly interested in meters and instruments would say that sufficient emphasis had not been placed on the significance of BH_{max} for a large number of cases. It would also have been an advantage to practical designers if more had been said in the paper about leakage coefficient.

DR. G. F. TAGG (English Electric Co.) said the author was interested in getting the magnet in as small a space as possible and getting as much flux as possible. He did not agree with the assumption that every particle of the magnet worked at the same point on its BH characteristic.

MR. PIZZEY (Elliott Bros., Ltd.) said the moving coil instrument maker tended always to design for stability rather than for maximum utilisation of the magnet material. In moving coil instrument design the sensitivity was proportional to the square of the increase in the flux density, and not directly proportional. Since modern magnetic materials were introduced some ten years ago, moving coil instrument designers had been faced with difficulties due to the changes in flux density.

MR. F. KNIGHT (Sheffield) referred to the development of anisotropic alloys which started some fifteen years ago and said that further improvements had taken place since the paper was prepared. The considerable approximation in the paper should be borne in mind. Reluctance could not be neglected, as it had been in the paper, particularly with apparatus working at high flux densities.

MR. J. PRINCE (Ferranti, Ltd.) said there was a lack of information both in the technical journals and in the paper on such a fundamental point as the stability of steel.

Author's Reply

The AUTHOR in his reply agreed that recoil permeability was a better expression than reversible permeability and said that since the paper was written there had been several further developments which had increased the curve factor from 0·42 in the case of isotropic materials and 0·58 for anisotropic materials up to 0·66, which related to the higher value mentioned by one or two speakers. Most of the magnets he used were small with cast steel pole shoes and the leakage along a magnet of that description was remarkably small. It all took place between the pole shoes and not along the magnet. With the horse-shoe type of magnet without pole shoes the leakage along the magnet was considerable. It was true that the calculations in the paper were made from the materials available when it was prepared and he agreed that better materials were now available. Indeed, he had had from Mr. Tyrrell's firms isolated samples which gave even more than the 5 million BH_{max}. Constancy had two meanings; one was did the steel remain constant, and on that he had very little information. The stabilisation of a magnet was another matter and he could offer no explanation of the gradual change over a period of time. Stabilisation could be effected by short-circulating or removing the armature.

Prospects for Contractors

Guidance for Would-be Entrants to the Industry

MANY inquiries are being received by the *Electrical Review* regarding the prospects for the electrical contracting industry after the war and the steps which have to be taken to open a contracting business. Most of these inquiries have come from civilians and Service men who have acquired, during the war, a certain amount of electrical knowledge which they consider qualifies them to start up as electrical contractors. It seems opportune, therefore, to publish an article in which advice is combined with warning.

As a preface it can be said with certainty that there will be a great volume of electrical work to be done after the war in the way of catching up five years' arrears and providing installations in the new houses which it is hoped will be erected by the hundred thousand in the next few years. It does not follow, however, that the opportunities for newcomers will be on the same scale, for there is likely to be a considerable revision of methods.

Probable Installation Methods

Houses will be erected in batches, sometimes of hundreds, and "pre-fabrication" will undoubtedly be applied in every possible way. In some types of building the electrical installation may be incorporated in actual pre-fabricated structural parts leaving little more than connecting up to be done. It is not anticipated that there will be a great deal of this for there are many drawbacks in such a method. The building-in of ducts or conduits may nevertheless become quite common as a means of minimising the cutting away or opening up which is so often necessary nowadays.

Everything possible will be done to reduce labour, and standardisation will be relied upon to enable the essential parts of an installation to be produced in such a form as to be easily assembled on the site. This seems to connote a kind of mass production which will require large-scale methods of installation and these can be expected only from contractors of a substantial size. There would seem to be few opportunities for the really "small" man employing two or three operatives.

But, of course, new houses will not be the only ones needing electrical facilities. All over the country there are still thousands of dwellings which are not yet enjoying the benefits of electricity. Many further thousands have only the sketchiest installations and require complete re-wiring if they are to be served according to modern conceptions of electrical service. Still others have installations which though fairly adequate are ageing and need renewal. Many thousands of bomb-damaged houses too will have to have their installations overhauled if not replaced. It is in these fields that would-be entrants to the contracting industry must look for their opportunities.

The Pre-War Position

The next point for consideration is conditions within the industry, with particular regard to its ability to meet the post-war demand. It was estimated before the war (on what basis we cannot say) that there were about 10,000 electrical contractors and men who masqueraded under that description. The membership of the Electrical Contractors' Association was in the neighbourhood of 2,000 and E.C.A. members formed the backbone of the National Register of Electrical Installation Contractors which did not include the names of as many as 1,000 who were not members of the E.C.A. A few reputable firms took no part in either the E.C.A. or the Register. Adding these groups to the E.C.A. membership there could not have been more than 4,000 reputable contracting firms in this country. Upon the whole these firms did fairly well, if comparatively few of them made fortunes, and between them they could probably have coped with the work which was done more or less satisfactorily by the 6,000 or so doubtful contractors most of whom have, it may be said, disappeared during the war.

Nevertheless, there was still scope for the enterprising man with the requisite knowledge, experience and capital and the conditions brought about by the war have certainly widened that scope. Consequently we would hesitate to advise any man possessing these essentials not to embark upon electrical contracting work. But we certainly must warn those without the necessary qualifications that rash entry into the business will almost certainly result in injury both to themselves and to the contracting industry.

Conditions of Entry

Now a word as to the conditions of entry. At the present time the controls which are being exercised preclude anybody from starting up as an electrical contractor without securing licences. Electrical contracting is regarded as a building operation and as such comes within the scope of the Orders made by the Ministry of Works under Regulation 56AB of the Defence Regulations. Without a licence a start is impossible, but even if a

licence is obtained there are difficulties to be surmounted in the obtaining and use of labour and materials.

There is also control by the Board of Trade under the Location of Retail Businesses Order, which prohibits the opening of premises, of whatever size or description, for the sale of goods which are normally sold retail. It has been held that this control of retail sales includes the majority of installation material, with the possible exception of conduit and cable. In so far as the majority of electrical accessories, switches, lampholders, plug-sockets and the like, are purchasable retail, no person can sell such accessories, even as part of an electrical installation, without a licence under the Location of Retail Businesses Order.

Licensing Considerations

The granting of a licence is, broadly speaking, governed by consideration of "consumer need"; with the present shortage of supplies it is very difficult to contend that the existing channels of distribution are insufficient to provide the public with its requirements even if there were no restriction. The granting of licences is dealt with by the Local Price Regulation Committees which operate under the auspices of the Board of Trade. Special latitude has been announced by the Government in respect of disabled ex-Service men who desire to start in business.

While "consumer need" is taken into consideration, so also is the register of traders who have withdrawn from business because of war circumstances. Generally speaking, licences are freely granted to disabled ex-Service men but only after having regard to businesses in the locality which were in existence before the war where the owner has registered with the Board of Trade to ensure his right to restart business in the same neighbourhood when he is free from service with the armed forces, or from the industrial occupation in which he is now engaged. It is, of course, not yet possible to say how long after the war these controls will be retained but it is unlikely that they will be removed for a considerable time.

Qualifications for E.C.A. Membership

Membership of the Electrical Contractors' Association is open to all bona fide electrical contractors, so long as they are qualified to undertake their responsibilities to the public, not only from a technical point of view but from the commercial aspect. Generally speaking, membership is not available unless the applicant has been in business for a period of at least three years on his own account, but it is understood that the Association treats every case entirely upon its merits, and in particular, with regard to ex-Service entrants to the electrical contracting industry, the qualification of at least three years in business will be interpreted generously in respect of those who would, otherwise, be fully qualified for membership.

The Association informs us that it will give information regarding membership to any who establish themselves in business, and those who are not in business but who desire advice can also apply to the E.C.A.

Starting as an Operative

All the foregoing has been concerned with the commencement of contracting businesses. Some Service men, not so immediately ambitious, desire only to enter the industry as operatives and for them the prospects are better. They have probably gained a good deal of electrical knowledge during their time with the Forces and intensive courses in installation work are included in the arrangements which the Government is making to prepare Service men for return to civil life. It is felt that these men are choosing the wiser course. Working as electricians they will gain invaluable experience while conserving their resources for the day on which they may feel that they are competent to start up on their own and have sufficient behind them to make a success of it.

Reference should be made to another factor which may possibly affect the electrical contracting industry. There is a strong movement afoot to secure the passage of legislation providing that all who wish to carry on business as electrical contractors or operatives shall be required to submit to examination and licensing. Combined with this there would be an obligation to carry out work according to an established code of rules—a requirement which some believe would be sufficient to ensure good installation work.

Information for Contractors

SINCE the War Emergency Supplement to the "Electrical Contractors' Year Book" and the booklet "Industrial Agreements and National Working Rules" were published a number of additions have been made. To bring the information in them more up to date the National Federated Electrical Association has issued a series of printed, perforated and gummed slips containing amendments which cover the period to May last year and the cost of living (war) addition charges up to and including October. A further series of slips will be issued as soon as possible giving later amendments.

The Board of Trade has now agreed that workers in retail establishments who are regularly engaged in handling and charging batteries are eligible for an issue of the "industrial ten" supplementary clothing coupons, providing they are so occupied for not less than 22 hours per week. Members who have on their staffs shop assistants or others qualifying for these coupons should make immediate application, utilising the procedure set out in Form T.C. 45.

ELECTRICITY SUPPLY

Battersea Bomb Damage. British Columbian Commission.

Aberdeen.—SUPPLY TO HOUSING SITE.—The Town Council is to provide a supply of electricity to a temporary housing site at Rosehill, and has approved the laying of cables at an estimated cost of £6,815.

Belfast.—LOAN FOR POST-WAR SCHEMES.—Belfast Administrators have decided to apply to the Ministry of Commerce for sanction to a loan of £1,079,004 for post-war electrical development.

Blackburn.—JUBILEE.—The Electricity Committee has decided to postpone the celebration of the 50th anniversary of the undertaking for a year by which time it is hoped the war will be over.

Bradford.—FLUORESCENT LIGHTING IN SCHOOL.—The Education Committee has authorised the installation of fluorescent lighting at Belle Vue High School at an estimated cost of £649.

Bromley.—TEMPORARY HOUSES.—The Council has decided to erect 377 temporary houses on bombed sites in the borough. Of these only 34 will be equipped with gas and the remainder will be " all-electric."

Cardiff.—PURCHASE OF VACUUM CLEANERS.—At a meeting of the Electricity Committee it was reported that 144 vacuum cleaners had been ordered at an approximate cost of £10 each, delivery to be spread over twelve months. The cleaners will be sold for cash.

Carlisle.—NO SIMPLE HIRE.—A recommendation by the city electrical engineer (Mr. A. C. Thirtle) that cookers shall not in future be let out on hire but only sold (for cash or on hire-purchase) has been approved by the Electricity Committee.

Chesham.—FRINGE ORDER.—The Chesham Electric Light & Power Co., Ltd., has obtained a Fringe Order to supply premises in Hemel Hempstead.

Chesterfield.—ALL-ELECTRIC HOUSES.—Having heard a report on the operating costs and merits of electricity for cooking and water heating, the Housing Committee recently decided that its temporary houses should be all-electric. When this was reported to the Electricity Committee it was agreed that the cost of the main cables, meters and service cut-outs, estimated at £1,100, should be borne by the Electricity Department and that while the work was being undertaken the distribution system in the vicinity should be improved at a cost of £1,150.

Croydon.—SWITCHGEAR.—The Town Council is recommended to approve the provision of switchgear, etc., in connection with temporary bungalows on the Long Heath housing estate. The expenditure is estimated at £14,617.

Guisborough. — HIGHER CHARGES. — The Council has been informed by the Electricity Commissioners that its application for approval of increases in electricity charges has been referred to the Ministry of Fuel and Power, which sees no reason to intervene in the Council's proposals.

Lichfield.—DOMESTIC TARIFFS.—The Electricity Committee reports that the West Midlands Joint Electricity Authority is considering the framing of a uniform domestic tariff.

UNDERGROUND CABLES.—Underground cables are to be laid in place of overhead lines to Whittington at a cost of £2,617.

London.—BOMB DAMAGE AT BATTERSEA.—After one of the substations of the Battersea Borough Council Electricity Department had received a direct hit during enemy raids on this country a temporary substation was erected, equipped and put into commission within two and a half days.

In other incidents the precautions which the Department had taken proved their worth. Mr. H. F. J. Thompson, the general manager and engineer, tells us that on one occasion a 500 lb. oil bomb fell on the control room at the generating station but as this had been provided with a special additional protecting roof only the nose of the bomb penetrated to the control room. The fire was confined to the ordinary

Effects of a direct hit on a Battersea substation

roof above the special roof and was subdued in about 10 minutes by the Department's own A.R.P. personnel and without interference with the supply of electricity.

The glazing and some parts of the roof of the generating station were blown away on another occasion, but as adhesive hessian sheeting had been applied to the glass, with wire netting below, no further damage occurred and the supply was not interrupted.

A bomb damaged one of the e.h.v. feeders which was in parallel with others supplying an important factory. Because of the special type of protection known as the " Bowden-Thompson," which operates before the main cores are reached, there was no disturbance of the supply and it was not interrupted.

Bombs which fell near Electric House

(general offices and mains, meters and installation departments) caused considerable damage, principally internally, but thanks to the local protection provided only two of about 60 persons who were in the premises were slightly injured by flying glass.

Middlesbrough.—SUPPLY TO NEW FACTORY.—The Town Council has received sanction from the Electricity Commissioners to borrow £3,026 for supplying electricity to a new factory.

Musselburgh. — ELECTRICITY PREFERRED. — "All-electric" was Musselburgh Town Council's decision with regard to lighting, cooking, etc., for the first temporary housing schemes at Stoneybank.

Reigate. — ANOTHER REBATE. — Alderman W. L. Lorkin, chairman of the Electricity Committee, reported at the last Council meeting that the Committee had decided to recommend another rebate of 20 per cent. on the March quarter's account. He pointed out this was the fourth year a rebate had been made. For some time the reduction of tariffs had been under consideration and he hoped to make a further report at the conclusion of the current financial year.

Southend-on-Sea.—DOMESTIC APPARATUS.—The Town Council is applying to the Electricity Commissioners for consent to borrow £8,366 for 250 electric cookers and 550 water-heaters.

Torquay. — DOMESTIC EQUIPMENT. — The Housing Committee has decided to install electric cooking and clothes washing apparatus in half of the temporary houses to be erected and gas equipment in the remainder.

Workington.—HEATING OF SWIMMING BATHS.—The Health Committee has considered the question of equipping the swimming baths with an electrically operated storage heating system and has asked the engineers to prepare estimates.

Overseas

Canada.—PROPOSED BRITISH COLUMBIAN COMMISSION.—A proposal to establish a Hydro-electric Commission in British Columbia was announced recently by the Premier, Mr. John Hart. The Commission would be empowered to purchase, develop and distribute electricity throughout the Province and would be authorised to acquire and consolidate companies now serving various areas. It would be granted $10 million in its first year of operation to carry out its plans.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

Associated Electrical Industries, Ltd.—The proposal to offer ten 8 per cent. £1 cumulative preference shares of Associated Electrical Industries, Ltd., for every eleven of the 1,500,000 7 per cent. cumulative preference of the British Thomson-Houston Co., Ltd., to consolidate the group of electrical companies was approved at an extraordinary general meeting last week. The resolution to increase A.E.I. capital by the creation of 1,360,000 8 per cent. cumulative preference shares was also carried unanimously.

The formal offer was made this week when it was pointed out that the exchange gave holders of the B.T.H. shares an increased income and entitled them to one vote at general meetings for each £2 of A.E.I. stock. The B.T.H. preference shares carry voting rights only in special circumstances. The offer remains open until March 16th.

The English Electric Co., Ltd., states that the net profit for the past year was £434,984, as compared with £419,346 in the preceding year. The ordinary dividend is again 10 per cent.

Franco Signs, Ltd., is to issue, with Treasury sanction, 160,000 new 10s. shares, partly to finance the re-equipment of subsidiaries for peacetime production. A special meeting is to be held to consider increasing the company's capital from £200,000 to £300,000 by the creation of 200,000 10s. shares. The 160,000 issued shares will be offered to shareholders, at 13s. per share, in the proportion of two new shares to each five at present held.

The London Electric Supply Corporation, Ltd., has declared an ordinary dividend of 6 per cent. for 1944 (same) of which 2 per cent. is to be paid out of the No. 2 reserve fund.

The Singapore Traction Co., Ltd., reports a revenue for 1943-44 from interest, etc., of £1,900 (against £1,765). After meeting debenture interest, etc., the loss for the year was £8,702 (against £9,059). To this are added debenture stock sinking fund instalment and dependents' payments, less reserve for income tax written back, making a debit balance of £9,096 (against a credit balance of £4,549). Refunds of income tax and E.P.T. have amounted to £64,515; the settlement of taxation questions will await the conclusion of hostilities in Singapore.

The Cape Electric Tramways Co., Ltd., reports a profit of £47,810 for the year ended June 30th last, after meeting expenses, debenture interest, etc., against £52,740 for 1942-43. The replacement reserve again receives £20,000 and the ordinary dividend is maintained at 6 per cent. It is stated that orders on behalf of subsidiaries valued at £350,000 are still delayed.

The Traction & General Investment Trust, Ltd., is paying a final dividend of 5 per cent., again making 7 per cent. for the year. The net revenue rose from £30,998 to £34,406.

The Southern Railway Co. is maintaining the dividend on its deferred stock at 2 per cent. for 1944.

The London Passenger Transport Board has decided to reduce its "C" stock interest from 3½ per cent. for 1943 to 3 per cent. for last year, by a final payment of 1¾ per cent. (The standard rate is 5¼ per cent.)

The Ship Carbon Co. of Great Britain, Ltd., announces a net profit of £94,581 for 1943-44 after providing for deferred repairs but before meeting taxation (against £152,002 for 1942-43).

Taxation requires £75,600 (against £134,100) and the dividend is again 10 per cent. Nothing is transferred to general reserve (against £6,556 from released taxation reserve); the balance carried forward is raised from £10,437 to £12,418.

Richard Johnson, Clapham & Morris, Ltd., have declared an interim dividend of 3¾ per cent. (as last year).

New Companies

Sealed Motor Construction Co., Ltd.—Private company. Registered February 12th. Capital, £10,000. Objects: To carry on the business of manufacturers of, and dealers in, electric motors for the operation of bore-hole pumps and other constructional, reciprocating and other pumps, electrical, marine and radio engineers, etc. Subscribers: N. Pensabene Perry, Royal Avenue Hotel, Bridgwater and W. Borkett, 6, Wimborne Avenue, Marlings Park, Chislehurst, Kent. Solicitor: G. R. Webb, 18, Bloomsbury Square, London. Registered office: Bristol Road, Bridgwater.

Applied Electronics (Great Missenden), Ltd.—Private company. Registered February 12th. Capital, £1,000. Objects: To acquire the business of electricians, electrical, electronic, telegraphic, telephonic, radio, television, mechanical, automobile and general engineers carried on by George E. W. Buller and others at Great Missenden. Directors: G. E. W. Buller, Leeward, Wendover Road, Great Missenden and two others. Registered office: Station Approach, Great Missenden, Bucks.

Lectrix (Bristol), Ltd.—Private company. Registered February 8th. Capital, £100. Objects: To carry on the business of electrical engineers and contractors, etc. Directors: W. E. Hunt, Westholme, Failand, Somerset; A. F. J. Wills, Avening, Long Ashton, Bristol; and F. H. Hunt, Lavender Cottage, Bathampton, Bath (all directors of Bristol Industries, Ltd.). Registered office: 8, Mitchell Lane, Victoria Street, Bristol.

Oldham & Son (Hire Purchase & Finance), Ltd.—Private company. Registered February 8th. Capital, £1,000. Objects: To carry on the business of hire-purchase and general financiers, financiers of the sale of miners' lamps, colliery requisites, electrical apparatus, etc. Directors: G. Oldham, Ferndale, Gee Cross, Hyde, Cheshire; J. Oldham, Gerrards, Gee Cross, Hyde; and E. C. Oldham, Cambridge House, Hyde Road, Gorton, Manchester (all directors of Oldham & Co., Ltd.). Registered office: 36, Hyde Road, Denton, Lancashire.

H. H. White & Co. (Wembley), Ltd.—Private company. Registered February 6th. Capital, £2,000. Objects: To carry on the business of electricians, electrical, mechanical and radio engineers, wire makers, machinists, metallurgists, etc. Directors: H. H. White and Agnes White, both of 208, Bridgewater Road, Wembley. Registered office: 208, Bridgewater Road, Wembley, Middlesex.

Harry Worth (Pudsey), Ltd.—Private company. Registered January 27th. Capital, £1,000. Objects: To carry on the business of electrical, mechanical, wireless, motor, lighting and heating engineers, etc. Directors: H. Worth and Mrs. Nellie Worth, both of West Mallion, Woodhall Park Avenue, Stanningley, near Leeds. Registered office: 18, Greenside, Pudsey, near Leeds.

Companies' Returns

Statements of Capital

Callender's Cable & Construction Co., Ltd.—Capital, £2,300,000 in £1 shares (1,500,000 ordinary, 400,000 preference and 400,000 "B" preference). Return dated July 17th (filed August 30th, 1944). 1,123,916 ordinary, 400,000 preference and 400,000 "B" preference shares taken up. £1,255,000 paid. £668,916 considered as paid. Mortgages and charges: Nil.

Bradford Electrical Services, Ltd.—Capital, £5,000 in £1 shares. Return dated August 10th (filed September 1st, 1944). All shares taken up. £5,000 paid. Mortgages and charges: Nil.

Public Utilities (Electric), Ltd. — Capital, £25,000 in £1 shares. Return dated October 25th, 1944. All shares taken up. £25,000 paid. Mortgages and charges: Nil.

Mid-Lincolnshire Electric Supply Co., Ltd.—Capital, £700,000 in £1 shares. Return dated October 26th, 1944. All shares taken up. £595,000 paid. £105,000 considered as paid. Mortgages and charges: Nil.

Lithanode Co., Ltd.—Capital, £3,000 in £1 shares. Return dated November 7th, 1944. 2,327 shares taken up. £627 paid. £1,700 considered as paid. Mortgages and charges: £5,000.

Glynceiriog Electricity Supply Co., Ltd.—Capital, £1,500 in £1 shares. Return dated November 11th, 1944. 1,000 shares taken up. £1,000 considered as paid. Mortgages and charges: Nil.

Increase of Capital

J. & J. Couch, Ltd.—The nominal capital has been increased by the addition of £4,000 in £1 ordinary shares beyond the registered capital of £1,000.

Mortgages and Charges

London Auto Electric Co., Ltd.—Satisfaction to the extent of £250 on March 1st, 1944, of debentures authorised December 7th, 1933, and registered December 9th, 1933, securing £500. (Notice filed February 3rd, 1945.)

Liquidations

Brimington Electric Supply Co., Ltd.—Meeting to be held at the National Schoolroom, Brimington, on March 22nd to hear an account of the winding-up by the liquidator.

Bankruptcies

A. A. Glossop, 33, Parkhead Crescent, Eccleshall, Sheffield, radio service engineer and radio dealer.—Second and final dividend of 1s. 3½d. in the £, payable March 3rd at 55, Queen Street, Sheffield, 1.

M. Tinner, electrical factor, residing and carrying on business as the Yorkshire Trading Company at 91, Porter Street, Hull.—Order made January 16th suspending discharge for three months.

STOCKS AND SHARES

TUESDAY EVENING.

THE firmness of Stock Exchange markets shows no sign of abatement. "Fear of peace" is forgotten. As the indications of victory draw into nearer focus, so does capital seek more insistently for means of employment in stocks and shares, investment and speculative alike. The demand for good-class preferences has lifted prices to a level at which the return is frequently less than 4 per cent. As for debenture stocks, their supply is largely dependent upon the realisation of deceased accounts.

Home Railway Dividends

The tale of the Home Railway final dividends for 1944 is now complete. The London Passenger Transport Board provided a mild shock by lowering the dividend on the "C" stock from 3¼ per cent. to 3 per cent. The Board explains this by reference to the windfall which occurred in the previous year's accounts which enabled it to pay an additional 5s. per cent. The price of the stock after being 69½, went back to 67½ ex dividend. The prior charge stocks remain firm, in correspondence with purely investment securities. The Southern Railway dividends repeat the performances of a year ago.

Central Electricity

The Central Electricity Board publishes impressive figures for the first time since 1939. Gross receipts from sales of energy rose by more than £30,000,000 during the first four years of the war, 1940 to 1943 inclusive. The details published by the Board will receive close attention from all who are interested in the production and distribution of electricity. The manner in which the Board has contributed to the war effort is brought out by the statistics available now that the ban has been partially lifted. The figures have no effect, of course, upon the quotations of the Board's securities in the Stock Exchange market, the prices of these issues being governed by the monetary situation. Clear evidence is presented of the vital part which electricity has played during the war, implying the scope that exists for expansion when peace returns.

Home Electricity

The South Metropolitan Gas Co. recently cut its previous dividend by 1 per cent., but the Gas, Light & Coke Co., a fortnight later, advanced its distribution by a similar amount. The South Metropolitan reduction led to some inquiry as to whether the electricity supply companies would be able to maintain their usual rates. More particularly those in the London group were thought by some people to have proved vulnerable to enemy action. The London Electric Supply Corporation, one of the subsidiaries of the London Power Co. declares a dividend of 4 per cent., making 6 per cent. for the year, the same as that of a year ago. Part of the dividend is drawn, as before, from reserve. The price of the shares rose last week by 1s. 6d. to 31s., and the improvement has been maintained. South London ordinary are 1s. higher at 31s.

Yorkshire Electric Power

One of the first of the provincial companies' results to be published is that of the Yorkshire Electric Power Co., which shows that the 1944 revenue of £816,805 exceeded that of the previous year by £35,000. The usual 8 per cent. dividend had already been announced and the balance sheet makes an excellent showing. The company gives comparative trading figures for four years, 1941 to 1944 inclusive. The price of the shares is 1s. higher at 44s. It is now considered practically certain that other companies in this group will exhibit equally satisfactory results, and that the electricity supply companies are not likely to reflect any serious damage from enemy action.

Price Movements

Most of the price movements noted this week are in the upward direction. Automatic Telephones at 64s. 9d. make one of the few exceptions. Calcutta Trams are another, losing the florin gain of a week ago. Chloride Electrical Storage at 88s. 9d., De La Rue at 9⅞ and Murex at 5⅛ are all 1/16 better. Hopkinsons at 76s. 3d. have regained their previous loss. Metal Industries "B" rose 2s. to 49s. Telegraph Constructions at 59s. are 1s. up. Siemens at 36s. 6d. are the pence better : so are Veritys at 9s. 3d. Animation characterises the radio group, where active demand has lifted E.M.I. 1/16 to 36s. Cossors, while the centre of lively dealing, did not get far away from 32s., and Philcos remained at 14s. 6d. E. K. Cole retained their advance to 41s. 3d. The effect has not yet worn off of the Government's intention to pay £700 million at the end of the war, in gratuities and post-war credits, to those who have served. Money is sure to be freely spent, says popular argument, on radio and television. Canadian Marconi made no further progress after last week's 2s. 6d. rise. International "Tel. & Tel." at 30 are again 1½ up. The last dividend paid on the shares was thirteen years ago.

English Electric

English Electric ordinary shares are 6d. easier at 56s. cum the dividend which makes 10 per cent. for the year ended December 31st last. The yield at the present price is no

(*Continued on page* 292)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend Previous	Dividend Last	Middle Price Feb. 20	Rise or Fall	Yield £ s. d.
Home Electricity Ordinary					
Bournemouth and Poole	12½	12½	63/6	..	3 19 1
British Power and Light	7	7	33/6	..	4 3 10
City of London	7	5½	30/–	..	3 13 4
Clyde Valley	8	8	42/–	..	3 16 0
County of London	8	8	45/–	..	3 11 1
Edmundsons	6	6	32/–	..	3 15 0
Elec. Dis. Yorkshire	9	9	45/6	..	3 19 6
Elec. Fin. and Securities	12½	13½	61/–	..	4 8 6
Elec. Supply Corporation	10	10	51/–	..	3 18 6
Lancs. Light and Power	7½	7½	37/6	..	4 0 0
Llanelly Elec.	6	6	28/–	..	4 5 9
Lond. Assoc. Electric	3	4	26/6	..	3 0 6
London Electric	6	6	31/–	..	3 17 5
Metropolitan E.S.	8	8	44/6	..	3 12 0
Midland Counties	8	8	41/6	..	3 17 0
Mid. Elec. Power	9	9	44/6	..	4 1 0
Newcastle Elec.	7	7	32/–	..	4 7 6
North Eastern Elec.	7	7	35/–	..	4 0 0
Northampton	10	10	50/6	..	3 19 4
Northmet Power	7	7	43/–	..	3 5 0
Richmond Elec.	6	6	27/–	..	4 9 0
Scottish Power	8	8	40/6	..	3 19 0
Southern Areas	5	5	23/–	..	4 7 0
South London	7	7	31/–	+1/–	4 10 4
West Devon	5	5	25/–	..	4 0 0
West Glos.	4½	3½	25/–	..	2 16 0
Yorkshire Elec.	8	8	44/–	+1/–	3 12 9
Public Boards					
Central Electricity :					
1955–75	5	5	116	..	4 6 0
1951–73	4½	4½	106	..	4 5 0
1963–93	3½	3½	105	..	3 6 8
1974–94	3½	3½	102	+1	3 3 9
London Elec. Trans.	2½	2½	98	..	2 11 0
London & Home Counties 1955–75	4½	4½	111	..	4 1 1
Lond. Pass. Trans. Bd.					
A	4½	4½	122½	..	3 13 6
B	5	5	123½	..	4 1 0
C	3½	3	67½xd	–½	4 9 0
West Midlands J.E.A. 1948–68	5	5	106½	..	4 14 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	6/3	..	—
Calcutta Elec.	6*	6*	47/6	..	2 11 2
Cawnpore Elec.	10	7	42/–	..	3 6 9
East African Power	7	7	36/–	..	3 17 9
Jerusalem Elec.	7	5	28/–	..	3 11 5
Kalgoorlie (10/–)	5	5	10/6	..	4 15 3
Madras Elec.	Nil	4	31/6	..	2 10 9
Montreal Power	1½	1½	24	–½	—
Nigerian Elec.	8	10	37/6	..	5 6 8
Palestine Elec. "A"	5*	5*	38/–	..	2 12 8
Perak Hydro-elec.	6	7	13/–	..	—
Tokyo Elec. 6%	6	6	23½	..	—
Victoria Falls & Power	15	15	90/–	..	3 7 7
Whitehall Inv. Pref.	—	6	26/–	..	4 12 4

Company	Dividend Previous	Dividend Last	Middle Price Feb. 20	Rise or Fall	Yield £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord.	10	15	62/–	..	4 16 9
Assoc. Brit. Eng.	6	7	53/9	..	2 12 0
Assoc. Elec. :					
Ord.	10	10	57/3	..	3 10 0
Pref.	8	8	40/–	..	4 0 0
Automatic Tel. & El.	12½	12½	64/9	–6d.	3 17 2
Babcock & Wilcox	11	11	53/6	+1/–	4 2 1
British Aluminium	10	10	46/–	..	4 7 0
British Insul. Ord.	20	20	117/–	+9d.	3 8 4
British Thermostat (5/–)	18½	18½	20/9	..	4 9 0
British Vac. Cleaner (5/–)	30	30	33/–	..	4 11 0
Brush Ord. (5/–)	8	9	11/–	..	4 1 6
Burco (5/–)	15	15	16/–	..	4 13 9
Callender's	15	20	117/–	+9d.	3 8 4
Chloride Elec. Storage	15	15	89/9	+¼	3 7 6
Christy Bros.	12½	17½	77/6	..	4 10 2
Cole, E. K. (5/–)	15	20	41/3	..	2 6 0
Consolidated Signal	24	27½	6½	..	4 0 0
Cossor, A. C. (5/–)	7½*	10*	32/–	..	1 11 4
Crabtree (10/–)	17½	17½	44/–	..	3 19 7
Crompton Parkinson Ord. (5/–)	20	22½	34/6	..	3 5 3
De La Rue	35	40	9½	+¼	4 1 0
E.M.I. (10/–)	6	8	36/–	+¼	2 4 6
Elec. Construction	10	12½	63/–	..	3 19 4
Enfield Cable Ord.	12½	12½	63/–	..	3 19 4
English Electric	10	10	56/–	–6d.	3 11 5
Ericsson Tel. (5/–)	22*	20*	54/–	..	1 15 9
Ever Ready (5/–)	40	40	44/–	..	4 11 0
Falk Stadelmann	7½	7½	34/9	..	4 6 2
Ferranti Pref.	7	7	32/6	+9d.	4 6 2
G.E.C. :					
Pref.	6½	6½	34/6	..	3 15 4
Ord.	17½	17½	98/6	..	3 11 2
General Cable (5/–)	15	15	19/–	..	3 19 0
Greenwood & Batley	15	15	48/3	..	6 3 0
Hall Telephone (10/–)	12½	12½	31/–	..	4 0 8
Henley's (5/–)	20	20	26/9	–6d.	3 14 9
4½% Pref.	4½	4½	24/–	..	3 15 0
Hopkinsons	15	17½	76/3	+2/–	4 11 10
India Rubber Pref.	5½	5½	24/–	..	4 11 9
Intl. Combustion	30	32½	7½	..	4 6 8
Johnson & Phillips	15	15	78/6	..	3 16 6
Lancashire Dynamo	22½	22½	102/6	..	4 10 0
Laurence, Scott (5/–)	12½	12½	13/9	..	4 11 0
London Elec. Wire	7½	7½	38/–	..	3 19 0
Mather & Platt.	10	10	56/3	..	3 11 2
Metal Industries (B)	8	8½	49/–	+2/–	3 9 6
Met. Elec. Cable Pref.	5½	5½	21/3	..	5 3 6
Mid. Elec. Mfg.	25	25	7½	..	3 9 1
Murex	20	20	5½	+¼	3 18 2
Newman Ind. (2/–)	20	20	7/3	..	5 10 0
Philco (2/–)	—	—	14/6	..	—
Power Securities	6	6	29/6	..	4 1 4
Pye Deferred (5/–)	25	25	33/9	..	3 14 0
Ransome & Marles	20	20	87/6	..	4 11 4
Revo (10/–)	17½	17½	44/–	..	3 19 7
Reyrolle	12½	12½	72/6	..	3 9 0

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend Previous	Dividend Last	Middle Price Feb. 20	Rise or Fall	Yield £ s. d.
Equipment and Manufacturing (*Continued*)					
Siemens Ord. ..	7½	7½	36/6	+6d.	4 2 4
Strand Elec. (5/–)	10	12½	11/6	..	5 8 8
Switchgear & Cowans (5/–) ..	20	20	20/9	..	4 16 7
T.C.C. (10/–) ..	5	7½	25/–	..	3 0 0
T.C. & M. ..	10	10	59/–	+1/–	3 7 9
TelephoneMfg.(5/–)	9	9	12/–	..	3 15 0
Thorn Elec. (5/–)	20	20	29/–	..	3 9 0
Tube Investments	20	22½	5⅞	..	4 2 10
Vactric (5/–) ..	Nil	22½	17/3	..	6 10 6
Veritys (5/–) ..	7½	7½	9/3	+3d.	4 1 1
WalsallConduits(4/–)55	55		53/–	..	4 3 0
Ward & Goldstone (5/–)	20	20	30/6	..	3 5 8
WestinghouseBrake	14	14	77/–xd	+1/6	3 12 8
West, Allen (5/–)	7½	7½	8/9	..	4 5 9
Traction and Transport					
Anglo-Arg. Trans.:					
First Pref. (£5)	Nil	Nil	2/6	..	—
4% Inc. ..	Nil	Nil	6½	..	—
Brit. Elec. Traction:					
Def. Ord. ..	45	45	1205	..	3 15 0
Pref. Ord. ..	8	8	190	..	4 4 3
Bristol Trams ..	10	10	57/–xd	+6d.	3 10 2
Brazil Traction ..	1¾	2	27½	+½	7 6 9
Calcutta Trams	6½	7½	65/6	–2/–	2 5 9
Cape Elec. Trams	5	6	26/–	..	4 12 4
Lancs. Transport	10	10	49/–	..	4 1 8
Southern Rly.:					
5% Prefd. ..	5	5	76½xd	–½	6 10 9
5% Pref. ..	5	5	119½xd	+1½	4 3 8
T. Tilling ..	10	10	61/6	..	3 5 0
West Riding ..	10	10	49/–	..	4 1 8
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	125	..	4 16 0
Def.	1½	1½	30	..	5 0 0
Anglo-Portuguese	8	8	27/6	..	5 16 4
Cable & Wireless:					
5½% Pref. ..	5½	5½	118	..	4 13 3
Ord.	4	4	85	+½	4 14 2
CanadianMarconi$1	Nil	4cts.	13/–	..	—
Globe Tel. & Tel.:					
Ord.	8¼*	5*	41/–	..	2 8 2
Pref.	6	6	31/–	..	3 17 5
Great Northern Tel. (£10)	Nil	Nil	29	..	—
Inter. Tel. & Tel.	Nil	Nil	30	+1½	—
Marconi-Marine..	7½	7½	34/6	..	4 7 0
Oriental Tel. Ord.	4	4	50/–	..	—
Telephone Props.	Nil	6	20/–	..	6 0 0
Tele. Rentals (5/–)	10	10	12/6	+3d.	4 0 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Continued from page* 290)

more than £3 11s. 5d. per cent. on the money, but the company's profit, £435,000, constitutes a record, having exceeded last year's figures which up to then had represented the company's peak profit. English Electric paid no dividend on its ordinary shares for the four years 1933 to 1936 inclusive, but from 1937 onwards the dividend has been a regular 10 per cent. and the price of the shares, down to 6s. at one time in 1935, is now 50s. higher.

It may be remembered that one of the English Electric Co.'s subsidiaries was Willans & Robinson. In December, 1942, the English Electric Co. acquired the majority of the ordinary shares of D. Napier & Son, Ltd., and the balance in the following year. The company's balance sheet is a good one; goodwill and patents are written down to £1. Investments in the 1943 balance sheet totalled £547,005, practically all of it represented by the holding in D. Napier & Son.

Telephone and Cable

The old Venezuela Telephone Co. became some years ago Telephone Properties, and the £1 stock units quoted at 20s., give a return of 6 per cent. on the dividend paid for the financial year 1943. In each of the two previous years, the company paid nothing, but the 6 per cent. just mentioned came from earnings of over 9 per cent. and it is thought likely that the company will repeat this distribution when the next accounts are published in May. Telephone Manufacturing shares are of 5s. each, and the dividend for the last few years has been 9 per cent. per annum. This, at the present price of 12s., will give 3¾ per cent.

Enfield Cable ordinary shares have come on offer at 64s. at which the yield is a modest £3 18s. per cent., and the ordinary shares of Enfield Rolling Mills can be bought at 23s. 6d. to pay 4½ per cent. Automatic Telephone & Electric give a yield of £3 17s. 2d. per cent. at the present price of 64s. 9d. on the last paid dividend making with the usual 2½ per cent. bonus, 12½ per cent. for the year.

Shares on Offer

Very few shares in companies connected with the electrical manufacturing and equipment trade can be bought to give a return of 5 per cent. on the money. Newman Industries may possibly come into this group and the 2s. ordinary shares, of which 5,000 are on offer at 7s. 3d., yield at that figure 5½ per cent. Lancashire Dynamo, available at 104s., will give £4 6s. 6d. per cent. and Christy Bros. ordinary at 80s., at which price shares can be obtained, yield £4 7s. 6d. Power Securities should make a useful purchase at 29s. 9d. ex dividend, at which a few hundred are offered. The return at that price is no more than £4 0s. 9d. per cent. on the money, but the outlook favours the longer view. Crabtree Electrical Industries 10s. shares at 44s. 6d. give £3 18s. 6d. per cent.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1*s. each*) *may be obtained from the Patent Office*, 25, *Southampton Buildings, London, W.C.*2.

AUTOMATIC Telephone & Electric Co., Ltd., C. Gillings and C. Rhodes.—" Telephone or like systems." 12179. July 27th, 1943. (567164.)

Automatic Telephone & Electric Co., Ltd., R. Taylor and G. T. Baker.—" Workmen's time-recording systems." 5274. April 2nd, 1943. (567205.)

Babcock & Wilcox, Ltd., R. J. Glinn and P. G. Handoll.—" Fluid heater cleaners." 12276. July 28th, 1943. (567166.)

F. J. G. Van Den Bosch, E. T. J. Tapp and Vacuum-Science Products, Ltd.—" Electron-discharge devices having light-sensitive cathodes." 11493. July 14th, 1943. (567190.)

British Thomson-Houston Co., Ltd.—" Electric welding systems." 10643/42. July 31st, 1941. (567176.) " Starting devices for electric-discharge lamps." 14277/42. October 11th, 1941. (567177.) " Electric device capable of transforming electric energy into radiant energy." 11996/43. July 24th, 1942. (567220.)

British Thomson-Houston Co., Ltd., and B. A. C. Tucker.—" Ultra-short-wave dipole aerials." 3665. March 5th, 1943. (567201.)

C. O. Browne and A. D. Blumlein.—" Multiple contact electric switches." 1584. January 26th, 1940. (567227.)

Cooke & Ferguson, Ltd., and R. Drucker.—" Machines for manipulating workpieces during welding and like operations." 19102. November 16th, 1943. (567197.)

Dubilier Condenser Co. (1925), Ltd., and R. J. Tungay.—" Electrical condensers." 12225. July 27th, 1943. (567165.)

Electric Furnace Co., Ltd., and W. Goldstein.—" Pipe joints." 11788. July 20th, 1943. (567159.)

C. H. Flurscheim and Metropolitan-Vickers Electrical Co., Ltd.—" Air or gas blast electric switches or circuit-breakers." 12297. July 28th, 1943. (567255.)

General Electric Co., Ltd., and L. C. Jesty.—" Photometers." 8579. May 28th, 1943. (567213.)

General Electric Co., Ltd., and J. M. W. McBride.—" Electric valve oscillators." 9835. June 18th, 1943. (567189.)

General Electric Co., Ltd., C. E. Ransley and S. V. Williams.—" Metal bodies, particularly those adapted to withstand high temperatures." 77. January 1st, 1943. (567127.)

R. Goldenberg.—" Electric tumbler switches." 21356. December 20th, 1943. (567199.)

A. J. Gum and Dowsing Co. (Electrical Manufacturers), Ltd.—" Dish and like washing machines." 15714. September 24th, 1943. (567140.)

O. E. H. Klemperer.—" Methods of detecting and measuring alternating electric potentials and electron-discharge devices therefor." 14131. September 12th, 1940. (567228.)

B. D. Lifschitz.—" Electric cigarette lighters and lighters for domestic purposes." 7916. May 18th, 1943. (567210.)

A. H. McGee.—" Compressors for refrigerators." 17605. October 26th, 1943. (567147.)

A. G. Mapp and K. R. Boydell.—" Electric resistance elements and apparatus for manufacturing the same." 6577. April 23rd, 1943. (567129.)

Marconi Instruments, Ltd., and C. F. Brockelsby.—" Apparatus for meaurement of dielectric properties of materials." 12135. July 26th, 1943. (567161.)

Marconi Instruments, Ltd., and J. Jackson.—" Electrode assembly for pH measuring systems." 12137. July 26th, 1943. (567162.)

Marconi's Wireless Telegraph Co., Ltd.—" Oscillation-generator system." 10705. July 1st, 1942. (567251.)

Mavor & Coulson, Ltd., and J. B. Mavor.—" Apparatus for mining." 10379. June 26th, 1943. (567157.)

E. J. Sherwood and G. D. Skinner.—"Electric light sources." 6113. April 16th, 1943. (567184.)

Sigma Instrument Co., Ltd., J. Loxham and F. R. Boosey.—" Automatic electrical integrating and averaging device for a variable medium." 14221. August 31st, 1943. (Addition to 557782.) (567195.)

Standard Telephones & Cables, Ltd.—" Amplifier circuits employing automatic volume control." 13149/43. August 18th, 1942. (567134.)

Standard Telephones & Cables, Ltd., and S. C. Shepard.—" Time controlled switching arrangements." 12394. July 30th, 1943. (567222.) " Circuit arrangements for periodically operating an electromagnetic relay." 18578/44. July 30th, 1943. (Divided out of 567222.) (Addition to 557707.) (567225.)

Standard Telephones & Cables, Ltd., E. G. Seath, S. Smith & Sons (England), Ltd., and E. C. Klepp.—" Remote control of condensers in electrical circuits." 12354. July 29th, 1943. (567256.)

Telephone Manufacturing Co., Ltd., S. J. Smith and R. G. St. Terry.—" Apparatus for magnetically recording, reproducing and transmitting speech and messages." 17023. November 30th, 1942. (567152.)

Ultra Electric, Ltd., and E. G. Fookes.—" Electric switches of the push-button type." 15541. September 22nd, 1943. (567139.)

L. Urmenyi.—" Protective means for moving-coil electrical measuring instruments." 12433. July 30th, 1943. (567257.)

J. Warne.—" Primary electrical batteries." 9718. June 17th, 1943. (567248.)

Westinghouse Electric International Co.—" Electronic systems for controlling current supply to welding and other loads." 7490/43. May 21st, 1942. (567209.)

Amended Specification.

558207. Burndept, Ltd., and others. " Construction of electric dry cells."

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—March 21st. Victorian State Electricity Commission. Paper and varnished cambric insulated cable (Spec. 44-45/41). April 4th. Electrical switchboard indicating and recording instruments (Spec. 44-45/25). July 4th. 40,000-kVA synchronous condenser (Spec. 45-46/1).

Belfast.—March 6th. Electricity Department. Materials including feeder and section pillars, armourclad compound-filled 6,600-V switchgear, meters and instrument transformers, l.v. fuse units, cut-outs, joint boxes, cables, lamps, switch tripping batteries and charging equipments, etc. (February 9th.)

Chesterfield.—March 1st. Electricity Department. One 500-kVA, 6,600/415-V, outdoor transformer. (See this issue.)

Manchester. — March 1st. Electricity Department. Four outdoor-type substation kiosks and switchgear. (February 9th.)

Newcastle-on-Tyne. — City Council. Electrical repairs at council houses. R. G. Roberts, city architect, 18, Cloth Market.

Plymouth.—March 10th. Electricity Department. Synchronous motor-driven time switches. (See this issue.)

Shipley.—March 2nd. Electricity Department. Supply and delivery of paper insulated cables for twelve months. (February 16th.)

Tynemouth.—February 24th. Town Council. Electric lamps for the year ending March 31st, 1946. Borough surveyor, 19-20, Howard Street, North Shields.

Orders Placed

Douglas (Isle of Man).—Electricity Committee. Accepted. Rectifying plant (£3,230).—Hewittic Electric Co.

Glasgow.—Transport Committee. Accepted. Asbestos covered wire.—London Electric Wire Co. & Smiths.

London. — SOUTHWARK. — Electricity Committee. Accepted. Cables for twelve months.—Scottish Cables. Meters (100 at £8 2s. 9d. each).—Chamberlain & Hookham.

Scarborough.—Corporation. Accepted. Installation of switchgear at Dean Road substation (£555).—Metropolitan-Vickers.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington. — Maternity home; H. Sanderson, borough surveyor, Town Hall.

Blackpool. — Hospital, Stanley Park (post-war); borough engineer.

Bootle. — Hostel, Balliol Road (£7,000); borough engineer.

Cardiff.—Rebuilding 32 houses (£25,300); Master Builders' Association.

Cheshire. — Extensions, Wrenbury Hall institution (£72,675), maternity home, Crewe (£18,000) and hostel, Northwich (£9,000); county architect, Chester.

Chester-le-Street. — Nurses' quarters at hospital; Fred Norman, builder, Chester-le-Street.

Cockermouth.—Houses (86) for North-Eastern Housing Association; Oldfield, Simpson and Saul, architects, National Provincial Bank Chambers, Workington.

Coventry. — Hostel, Cheylesmore estate; D. E. E. Gibson, city architect, 1a, Warwick Row.

Darlington. — Extensions to the Rise Carr Rolling Mills (£500,000); Darlington Rolling Mills Co., Ltd.

Dundee.—Workshops, etc., at Trade's Lane for Lamb's Garage, Ltd.; manager.

Durham.—Extensions at Finchale Hospital to accommodate 60 trainees and staff; W. & T. R. Milburn, 17, Fawcett Street, Sunderland.

Essex.—Practical instruction block at Brentwood Senior School (£3,690); J. Stuart, county architect, Chelmsford.

Fife.—New County Hall and extensive alterations and improvements to buildings at Cupar to cost £100,000 (post-war scheme); county architect, Cupar, Fife.

Gateshead.—Junior and infant schools at Highfield, Deckham and Shipcote, and civic centre on St. Alban's site; borough engineer.

Glasgow.—Important post-war extensions at University including new departments, costing approximately £1,080,000; principal.

Proposed extensions at Hillington Industrial Estate; manager.

Manchester. — Extensions to pathological laboratories at Withington and Crumpsall Hospital (£2,450); G. Noel Hill, city architect.

Mansfield.—Rehabilitation centre at General Hospital, Crow Hill Drive; governors.

Middlesbrough.—Plans approved for licensed premises, Saltersgill Avenue (£20,000); Beverley Bros., Ltd., brewers, Wakefield.

Nottinghamshire. — Farm training institute (£20,000); county architect, Shire Hall, Nottingham.

Rugeley.—Air compressor station; Willcox, Raikes & Marshall, civil engineers, 33, Great Charles Street, Birmingham, 1.

Salford. — Works extensions; Universal Metal Products, Ltd., Langley Road, Pendleton, Salford, 6.

Scotland.—New buildings and plant in Renfrewshire, Lanarkshire, Dumbartonshire, etc.; secretary, Regional Board, Edinburgh.

Stockport.—Warehouse, garage, canteen and workshop; Herbert Parkes & Nephew, Ltd., constructional engineers, St. Petersgate, Stockport.